Reflections of S-STEM Faculty Mentors

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Reflections of CSEMS and S-STEM Faculty Mentors

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Abstract

Across college campuses it has long been held that, aside from teaching and research, student mentoring is one of the primary duties of faculty. For 15 non-consecutive years from 2002 through 2018, South Dakota State University (SDSU) was awarded grants from the National Science Foundation for undergraduate scholarship/mentoring programs known as Computer Science, Engineering, and Mathematics Scholarships (CSEMS), or Scholarships for Science, Technology, Engineering, and Mathematics (S-STEM). The literature includes some descriptions, reviews, and assessment recommendations for CSEMS and S-STEM programs, but there is a gap in reporting reflections of faculty mentors after participation. The situational perspective of this research is interpretivism, where findings were interpreted and the results may or may not be generalizable to other contexts. Through this approach, the research question was tested: *In the opinion of CSEMS and S-STEM faculty mentors, what were the benefits, if any, of the program on participating students, faculty mentors, the Colleges involved, as well as SDSU as an institution?* This is a mixed methods case study, where 15 of 43 former CSEMS and S-STEM faculty mentors who served in those programs at any time from 2002 to 2017 at SDSU, completed a short-answer survey providing basic descriptive data about themselves and their activities in the programs. Of most importance, however, they wrote essays in response to a series of questions designed to prompt reflections on their experiences within the programs. From the essays, consensus themes were extracted that may be useful to better understand and potentially improve scholarship/mentoring programs.

Key words: scholarship/mentoring program, undergraduate STEM majors

Introduction

Faculty mentoring has long been recognized for contributing to the success of students and for the personal satisfaction and other benefits it provides for the mentors. In this paper, faculty mentors at South Dakota State University (SDSU) described their practices and activities in a long-running scholarship/mentoring program, and they reflected on their experiences.

Since mentoring has been ongoing since ancient times, we acknowledge precisely what is meant by the term as used in this paper. A wide variety of definitions of mentoring exist. In settling on a working definition of the "latent constructs" of mentoring, the following, as recommended by Nora and Crisp [1], was adopted for purposes of the present research, as follows.

> [F]our major domains or latent constructs are identified in the literature as comprising mentoring. The four domains combine theoretical perspectives from educational, psychological, and business theories by Cohen and Galbraith [2]; Kram [3]; Schockett and Haring-Hidore [4]; Levinson, et al. [5]; Miller [6]; and Roberts [7]. The four latent constructs include: 1) psychological or emotional support, 2) support for setting goals and choosing a career path, 3) academic subject knowledge support aimed at advancing a student's knowledge relevant to their chosen field, and 4) specification of a role model.

Overview of SDSU Scholarship/Mentoring Program

Beginning in 1999, the National Science Foundation (NSF) began a program known as Computer Science, Engineering, and Mathematics Scholarships (CSEMS) [8]. It was broadened to include other fields and became known as the Scholarships for Science, Technology, Engineering, and Mathematics (S-STEM) program. The goals established by NSF [9] were to provide scholarships and mentoring to undergraduate college students with demonstrated financial need and academic talent to increase their retention and graduation success rates, while encouraging students to pursue graduate studies or to engage in employment in their chosen field. SDSU participated in the programs for 12 nonconsecutive

years in three separate grants over the span of 2002 to 2018. From 2012 through 2018, SDSU referred to their S-STEM program as Opportunities, Mentoring, Education, Growth, and Academics (OMEGA). During the years of SDSU's participation in CSEMS and S-STEM, 43 faculty members mentored 198 students in this highly successful program. For the 2012 through 2018 OMEGA program, the participant grade point average was 3.55 including 3.39 for females. Of that group, 38 percent of participants graduated with a STEM degree, with 91 percent on track to graduate with a STEM degree as of January 2018.

The following were aspects of the OMEGA program.

- Scholarships ranging from $3,000 to $5,000 per year
- Faculty mentoring
- Involvement in campus clubs and organizations
- Making industry contacts in student's field of interest
- Educational enhancement activities
- Peer mentoring
- Yearly program meetings
- Student travel to conferences and other graduate schools

Literature Review

Dewey, as early as the 1930s [10], was one of the first to note that teacher reflection was critical for intentional self-improvement practices, positioned at the intersection of knowledge and experience in experienced-based theories. Since 1983, Schon's [11] - [12] theory of "reflective practitioners" was widely influential in educational settings, wherein he differentiated between reflection-on-action and reflection-in-action. An example of reflection-on-action would be a teacher's reflection on a recently used teaching method and how it might be improved. An example of reflection-in-action would be the same teacher's later reflection that the improvement was not working as expected and needed to be revised.

After 1993, Tinto [13] was influential in drawing attention to the value of mentoring and inquiry into why students leave college, noting the importance of academic and social integration into campus life so that students can best utilize available resources through connections with other students, faculty, staff, and administration.

There are many articles about CSEMS and/or S-STEM scholarship/mentoring programs in the literature (e.g., [14] - [20]), some including outcomes, activities, implementation, evaluation, or a recommended model. Mentoring is increasingly recommended to improve student retention and graduation for all students, but particularly for minorities underrepresented in STEM fields (e.g., [21] - [24]).

Methodology

The research question for this study was, *from the perspective of faculty mentors in CSEMS or S-STEM at SDSU, what were the benefits, if any, of those programs for student mentees, faculty mentors, departments, colleges, and the overall university?* The theoretical perspective for this research is within the "situational perspective" of "interpretivism" as noted by Case and Light [25 after 26], where the point is to interpret participants' subjective experiences, rather than testing hypotheses with random sampling, control groups, and statistically defensible cause and effect. Generalizability to other contexts is left to the judgment of the reader within this perspective [25 after 27].

Methodologically, this is a case study for college educators, where CSEMS and/or S-STEM faculty mentors completed a short answer survey of 12 questions, including general background information as follows. In the mixed methods reflection instrument, faculty mentors provided quantitative responses when asked to provide the number of years they served as faculty and the number of years they served as a CSEMS or S-STEM mentors for undergraduate students. They provided quantitative and/or qualitative responses to open-ended questions about previous mentoring experience and formal mentor training, if any. As

the main focus of their responses, they wrote short essays, qualitative responses to open ended questions where they reflected on professional development of students and of themselves as faculty as a result of their participation in CSEMS or S-STEM programs. Under "Other Remarks," some provided qualitative statements reflecting on the effect of the programs on their departments at SDSU, the Jerome J. Lohr College of Engineering, and SDSU as an institution (Appendix).

Results

Fifteen of 43 faculty mentors for CSEMS and/or S-STEM at SDSU completed e-mail surveys. Completed surveys were returned by e-mail, and identities were removed and replaced with a number. Participants were assured of anonymity. Quantitative data was extracted from the surveys (Table 1), indicating that the participants had from 5 to 29 years of experience as faculty and served as CSEMS and/or S-STEM mentors for 2 to 16 years. Five had previous mentoring experience. Three had formal training as mentors, but the training was for first year faculty mentoring, not student mentoring. One had prior training in a workshop for faculty as mentors for students. Essays ranged from 0.25 to 1.5 pages of single spaced size 12 font on an 8.5 x 11 inch page.

Table 1. Faculty mentor quantitative data.

Faculty Mentor No.	# Years As Faculty	# Years as CSEMS or S-STEM Mentor	Previous Mentoring Experience	Formal Mentoring Training
1	22	12	no	no
2	20	2	no	no
3	5	3	yes	no
4	10	4	no	no
5	20	7	no	no
6	8	8	no	yes
7	25	4	yes	yes
8	28	6	yes	no
9	19	14	no	no
10	18	11	no	no
11	3	1	yes	yes
12	12	12	no	no
13	29	16	no	no
14	5	2	no	no
15	21	12	yes	yes

As noted (in Methodology and Appendix), mentors were asked to write reflective essays on their CSEMS and/or S-STEM experience on the following six topics with a major focus on the first three: (1) student participants' professional development, (2) non-C-SEMS or non-S-STEM) advisees' professional development, (3) faculty mentor's professional development, (4) faculty mentor's department, (5) the Jerome J. Lohr College of Engineering and (6) SDSU. The reflective essays were color coded by themes that emerged through reading the group of essays three times and arriving at consensus. Since topic number 2 was rarely included in the faculty essays, it was eliminated. Numbers 4, 5, and 6 were combined. During analysis of the responses, the remaining three topics were assigned three broad headings by overall subject, and a fourth broad heading that emerged was added. The final headings/themes were as follows: (I) student participants' benefits; (II) faculty mentors' benefits; and (III) departments', colleges', and SDSU's benefits, and (IV) areas that need work. The number of faculty mentor respondents is listed after each theme as follows.

I. Student participants' benefits

(a) Professional development for students theme [13 of 15 respondents]

- Sufficient time with faculty to build a trusting professional relationship
- Industry mentor contacts to help develop a career choice
- Participation in a professional society
- Increased consideration of attending graduate school
- Opportunities to form networking for internships and future employment
- Leadership development
- Increased understanding of career options and relevant courses
- Advantages in job searches

As examples, surveyed faculty mentors commented as follows.

> "I believe the professional development of my mentees was accelerated for three reasons. First, they were required to spend a significant amount of time with their faculty mentors starting their first month of college, and second, because of their industry mentor contacts that also started their freshman year. . . . Finally, the requirement of having to participate in a professional society also accelerated their professional development because it provided an opportunity to interact with faculty, industry speakers at meetings, and upper-class students." (Faculty mentor #1)

> "The program requirements include active participation in a professional society. Several of my mentees were not only active participants in their chosen society but took on leadership roles in organizations such as SWE [Society of Women Engineers], Engineers without Borders, and the Human Powered Vehicle Team. These leadership experiences had very positive effects on their professional skills development, which I believe gave them advantages in their job searches. (Faculty mentor #6)

> ". . . [S]tudents were required to participate in professional development activities. Having these mentees attend, for example, our resume workshop or network with our advisory board made them find time for these activities; whereas, other advisees often opted to skip these activities. I believe this helped the CSEMS/S-STEM mentees in the job search process." (Faculty mentor #10)

> "[Some] not only attained their BS degree but then went on to study for and earn an MS degree. Some have even gone on to study for PhDs. This was a huge accomplishment of the program although it was not specifically assessed. . . . The number of engineering society officer positions in the college included a large percentage of OMEGA mentees. For these mentees, there were more opportunities for leadership training which in some cases was required as part of being an officer. The mentees who chose this path benefited greatly as they became part of the larger academic community and were able to make connections outside SDSU on a regular, although required basis. (Faculty mentor #15)

(b) Social support for students theme [14 of 15]

- Faculty and peer social structure to support student success
- Emotional support and guidance for students' personal lives both in an out of class
- Reduction of financial stress
- Involvement in campus activities and attachment to SDSU

As examples, surveyed faculty mentors commented as follows.

> "I believe that the mentoring experience helped students a lot--sitting down and discussing with each student their overall in-class and out-of-class experiences for half an hour on a regular basis. At least it brought to the surface any issues that they may have been experiencing and talking about them, I think, helped tremendously." (Faculty mentor #8)

> " I came to realize the importance for a student to have a stable family/social structure to support student success. . . .We would have to provide a community not only of students, but, seasoned professionals and community members who can build those personal relationships that make the student feel like family. They need emotional support and guidance for their personal lives especially when they come from a place that does not understand the demands and rigor of academic life." (Faculty mentor #2)

> ". . . Some of the students were already heavily involved on campus either in the Greek system or perhaps as a CA [Community Assistant] in a residence hall. . . .However, several students that were not active on campus were forced to get out of their comfort zones and go to activities on campus. Some of these were pleasantly surprised, and some were not too excited about [it]. I believe that overall it benefited them and may have encouraged them to become more active on campus." (Faculty mentor #9)

(c) Academic support for students theme [9 of 15]

- Faculty advice about academic choices and study habits
- Freedom from outside employment for those students who need the time for study
- Directed to more on-campus resources

As examples, surveyed faculty mentors commented as follows.

> "I met with the student bi-weekly and acted as an unofficial academic and personal advisor. Being in-line with the program requirements, I encouraged my advisee to branch out and attend non-academic activities on campus, attend professional development activities, and apply to internships. Each week we met, I would ensure that the student was on track with [his or her] academics, and if there were concerns that could be addressed." (Faculty mentor #11)

> "Typically, the students chosen for the program are the type of students who can do really well, but without the scholarship, would be forced to spend a significant amount of time working a part-time outside job. This extra time generally causes the students to be unable to study as much as necessary to truly learn and master the material. With the reduction of financial stress, these students generally perform much better and are able to pursue their chosen career trajectory." (Faculty mentor #3)

II. Faculty mentors' benefits

(d) Professional development for faculty mentor theme [13 of 15]

- Increased awareness of extramural activities and academic resources on campus
- Gained from listening to the student perspective
- Realized the importance of social support in student success in campus life
- Better understood the time and commitment required to build personal relationships beyond the usual advisor/advisee situation
- Saw that first-generation college students need more guidance because of the potential for lack of understanding and family support for the challenges of academic life
- Enjoyed developing closer relationships with students
- Became more aware of industry and technology trends

As examples, surveyed faculty mentors commented as follows.

> ". . . [The] program made me more aware of the extramural activities on campus and other academic resources that I could steer other students to as well. . . . For my own professional development, having more intentional and longer conversations with students across all four class years helped me identify issues in scheduling, advising, campus support, housing, employment, dining and other campus offices that affected the students. Many of these topics might not have been communicated in the typical once a semester meeting with an advisee, but meeting as much as twice a month with the mentees provided the opportunity for increased depth and breadth of our conversations." (Faculty mentor #1)

> "While I do try to work on my advisees on more holistic planning when they meet with me each semester in their course plans, it pales in comparison with the opportunities we can meet in the OMEGA scholars. (Faculty mentor #4)

> "I enjoy developing deeper relationships with my students; so my professional development was focused on building those relationships. (Faculty mentor #7)

> "As an advisor, the program helped me to have more interaction with the industry and technological trends. (Faculty mentor #13).

III. Departments', colleges', and SDSU's benefits

(e) Institutional impacts theme [11 of 15]

- Scholarship support helped in recruiting and retaining well-qualified students
- Mentored students were likely to be involved in campus activities at all levels.
- Increasing the overall scholarship pool made it possible to offer scholarships to more students who may not succeed without the financial support
- Provided the extra mentoring support often needed by first-generation college students to succeed.
- Feedback from the student and faculty mentor perspectives helped to improve delivery of services and create a culture of success.

As examples, surveyed faculty mentors commented as follows.

> "I found that mentoring students in an S-STEM scholarship program has given me a much better opportunity to talk candidly and at length to students in our major that I did not get to do with students I am not mentoring -- including my non-STEM academic advisees. My conversations with the mentees have given me many insights into the Jerome J. Lohr College of Engineering that I would not have had otherwise -- which courses were perceived to be the most or least beneficial, the easiest or hardest classes, the strengths and weaknesses of some of the faculty members, how policies in the courses and college affect the students, how much time is spent on academics, tools and resources that students use to help them with their classes, and how students approach the job search. Without mentoring I believe I would be much less in tune with how the students operate in our department, college, and university." (Faculty mentor #5)

> "I mentored 19 students in this program and 18 of them graduated with a Civil Engineering degree from our program, and seven (and counting) went on to stay at our program for graduate studies in Civil Engineering. That is pretty impressive." (Faculty mentor #9)

> "I am able to gain from the perspectives of the student participants and help shepherd them to opportunities to strengthen our department, the college, and the university." (Faculty mentor #4)

IV. Areas that need work

(f) Areas of concern [1 of 15]

As examples, a surveyed faculty mentor commented as follows.

- "Peer mentoring was not viewed positively by any of my mentees. . . .There was also a feeling that the "senior" peer mentor didn't actually know anything useful to share with an incoming student as they were 'just another student.'" (Faculty mentor #15)

- Many of the mentees did not understand what professional development meant or how the activities that were structured as part of OMEGA were related to their professional development." (Faculty mentor #15)

Summary and Conclusions

From the situational perspective of interpretivism, this case study presents extracted themes from reflection essays by 15 of 43 CSEMS and/or S-STEM faculty mentors. They served for any length of time in an NSF scholarship/mentoring program at SDSU during twelve nonconsecutive years of the program from 2002 to 2017. Consensus themes were extracted from the faculty mentors' reflection essays based on a set of open-ended questions that were provided to them (Appendix). The vast majority of faculty mentors reported that student participants benefited from the program, aside from the obvious financial assistance, through professional development, as well as social and academic support. One faculty mentor wrote about areas of concern that could be improved in the program. Faculty mentors benefited through professional development, especially through building better skillsets as student advisors. Departments, colleges, and SDSU benefited through the energizing leadership of many program mentees in a variety of campus activities and organizations.

Since some faculty mentors were department heads, assistant department heads, and other higher level administrative leaders, they gained valuable insight into the day-to-day student experiences of their mentees. That was an especially valuable aspect of the program, since those mentors were and are in positions where they can most effectively advocate for systemic improvements and advocate for implementation of program successes across the entire campus.

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References

[1] A. Nora and G. Crisp, "Mentoring students: Conceptualizing and validating the multi-dimensions of a support system," *Journal of College Student Retention*, vol. 9, no.3, pp. 337-356, 2006.

[2] N. Cohen and M. Galbraith, "Mentoring in the learning society," *New Directions for Adult and Continuing Education*, vol. 66, pp. 5-14, 1995.

[3] K. Kram, *Mentoring at work: Developmental relationships on organization life.* Glenview, IL: Scott Foresman, 1988.

[4] M. Schockett, and M. Haring-Hidore, "Factor analytic support for psychosocial and vocational mentoring functions," *Psychological Reports*, vol.57, pp. 627-630, 1985.

[5] D. Levinson, C. Carrow, E. Klein, M. Levinson, and B. McKee, *The seasons of a man's life.* New York, NY: Ballentine, 1978.

[6] A. Miller, *Mentoring students & young people: A handbook of effective practice.* London, UK: Kogan Page, 2002.

[7] A. Roberts, A. "Mentoring revisited: A phenomenological reading of the literature," *Mentoring and Tutoring*, vol. 8, no. 2, pp. 145-170, 2000.

[8] National Science Foundation, "NSF Computer Science, Engineering, and Mathematics Scholarships (CSEMS)," (archived), 2001. https://www.nsf.gov/pubs/2001/nsf0162/nsf0162.htm [Accessed Jan. 10, 2018].

[9] National Science Foundation, "NSF Scholarships in Science, Technology, Engineering, and Mathematics, 2016." (Nov. 30, 2017). https://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf17527 [Accessed Jan. 10, 2018].

[10] J. Dewey, *Experience and education*. New York, NY: Collier, 1963.

[11] D. Schon, *The reflective practitioner: How professionals think in action*. New York, NY: Basic Books, 1983.

[12] D. Schon, *Educating the reflective practitioner*. San Francisco, CA: Jossey-Bass, 1987.

[13] V. Tinto, *Leaving college: Rethinking the causes and cures of student attrition*. 2nd ed. Chicago, IL: University of Chicago Press, 1987.

[14] M. Anderson-Rowland, A. Rodriguez, R. Hall, P. McBride, R. Pangasa, J. Saber, C. Vangilder, and A. Grierson, "Leveraging S-STEM scholarship programs," in *Conference Proceedings of 119th ASEE Annual Conference and Exposition,* San Antonio, TX, 2012.

[15] J. Gerhardt and B. Olsen, "Small colleges can get big NSF grants," in *Proceedings of ISECON*, vol. 21, pp. 1-4, 2004.

[16] M. Kalevitch, C. Mauer, P. Badger, G. Holdan, J. Iannelli, A. Sirinterlikci, G. Semich, and J. Bernauer, "Building a community of scholars: One university's story of students engaged in learning science, mathematics, and engineering through a NSF S-STEM grant," *Journal of STEM Education*, vol.13, no. 4, pp. 34-42, 2012.

[17] L. Olson, A. Moll, D. Bullock, A. Jain, and J. Callahan, "Support model for transfer students utilizing the STEM scholarship program," in *Proceedings of 123rd ASEE Annual Conference & Exposition*, June 26-29, New Orleans, LA. Boise State University Scholar Works, Materials Science and Engineering Faculty Publications and Presentations, Department of Materials Science and Engineering. Paper ID#16411, 2016.

[18] S. Sorkin, T. Tingling, A. Beiderman, and J. Walker, "Promoting computer science, engineering, and related programs with scholarships and student support services," in *ASEE/IEEE Frontiers in Education Conference,* October 19-22, Indianapolis, IN, S2C-21 - S2C-27, 2005.

[19] Z. Wilson, S. Iyengar, S. Pang, I. Warner, and C. Luces, "Increasing access for economically disadvantaged students: The NSF/CSEM & S-STEM programs at Louisiana State University," *Journal of Science, Education, and Technology*, vol. 21, pp.581-587, 2012.

[20] K. Yue, S. Hall, S. Tiu, A. Reilly, and S. Davari, "A case study of metrics for assessing STEM scholarship programs," Consortium for Computing Sciences in Colleges : South Central Conference, *The Journal for Computing Sciences in Colleges*, vol. 26, no. 4, pp. 6-13, April, 2011.

[21] K. Kendricks, K. Nedunuri, and A. Arment, "Minority student perceptions of the impact of mentoring to enhance academic performance in STEM disciplines," *Journal of STEM Education*, vol.14, no. 2, pp. 38-44, 2013.

[22] C. Morgan, "Mentoring: A pathway to student achievement in science, technology, engineering, and mathematics at historically Black colleges and universities," in *Advancing educational outcomes in science, technology, engineering, and mathematics at historically Black colleges and universities*. L. A. Flowers, L. O. Flowers, and J. Moore, eds., Lanham, MD: University Press of America, Inc., pp. 99-117, 2016.

[23] F. Nave, F. Bonner, C. Lewis, S. Frizell, A. Parker, M. McFrazier, and P. Robinson, "African American students' academic achievement in STEM at HBCUs," in *Advancing educational outcomes in science, technology, engineering, and mathematics at historically Black colleges and universities*. L. A. Flowers, L. O. Flowers, and J. Moore, eds., Lanham, MD: University Press of America, Inc., pp. 119-136, 2016.

[24] D. Wallace, R. Abel, and B. Ropers-Huilman, "Clearing a path for success: Deconstructing borders through undergraduate mentoring," *The Review of Higher Education*, vol. 24, pp. 87-102, 2000.

[25] J. Case and G. Light, "Emerging methodologies in engineering education research," *Journal of Engineering Education,* vol. 100, no.1, pp. 186-210, 2011.

[26] M. Koro-Ljungbert and E. Douglas, "State of qualitative research in engineering education: Meta-analysis of JEE articles, 2005-2006," *Journal of Engineering Education,* vol. 97, no. 2, 163-175, 2008.

[27] Y. Lincoln and E. Guba, *Naturalistic inquiry*. Beverly Hills, CA: Sage, 1985.

Appendix

Reflection Instrument for Faculty Mentors in CSEMS or S-STEM Programs

The data collected will be anonymous, and it may be used in a professional paper to be presented at an engineering or STEM educational conference. You do not need to participate, and there are no negative consequences for non-participation. You may stop participating at any time after you start, and the partial information provided by you will not be included in the final data. Your participation involves no risks. There is no financial compensation provided if you participate. By participating, you may help to improve faculty mentoring programs at South Dakota State University (SDSU) and at other schools in the future. Completing the reflection instrument should take about ***20 minutes of your time****.*

Please provide numbers as responses for questions 1 and 2. Answer questions 3 and 4 with "yes" or "no." If "yes," please explain. For question 5, write an essay reflecting on your mentoring of students in the CSEMS or S-STEM programs at SDSU).

1. Number of years you served in a faculty role ____.
2. Number of years as a CSEMS or an S-STEM mentor____.

3. Have you had previous experience with mentoring prior to becoming a CSEMS or an S-STEM mentor? ____ If yes, explain:

4. Have you had formal mentoring training? ____ If yes, explain:

5. Please write an essay explaining how your experiences as a CSEMS or an S-STEM mentor affected each of the following (a through f) with a *major focus on (a) through (c)*, and other remarks directed to (d) through (f).

FOCUS

a. The mentored CSEMS or S-STEM student participants' professional development

b. Your non-CSEMS or non-S-STEM advisees' professional development

c. Your professional development

OTHER REMARKS

d. Your SDSU department

e. The Jerome J. Lohr College of Engineering

f. SDSU as an institution

The (university acronym) Office Research Assurance and Sponsored Programs has determined that this research is exempt from the Common Rule: Approval #: IRB-1712014-EXM.