Supportive Mentoring Practices Based on Undergraduate Experiences

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An Investigation of Supportive Mentoring Practices

Abstract

A recent study shows that 30% of undergraduate students are successful in completing degrees in STEM fields, of those only 29% are from historically underrepresented groups.[1] During the past decade, the number of undergraduate students pursuing degrees in STEM fields from underrepresented groups has increased only by 3%.[2] In order to address the significant need for the completion of degrees in STEM fields by underrepresented groups, efforts to develop effective mentoring practices have been undertaken. Mentoring has proven to be an effective mechanism for ensuring student success in STEM fields. Select mentoring programs for women, minorities, and underrepresented groups have shown significant gains in increasing the presence of students from various backgrounds in the STEM fields.[3] Mentoring provides participants from underrepresented groups with exposure to role models, support networks, and other mechanisms that help them succeed in STEM fields.[7] Attracting more students from underrepresented populations into the STEM workforce will maximize innovation, creativity, and competitiveness.

The present research study reviewed, characterized, and analyzed the various practices, procedures, and policies of successful mentoring programs. Survey instruments composed of 22 questions were used to learn about the mentoring experiences of graduate students in STEM fields during their undergraduate matriculation, particularly if they benefited or failed to benefit from their mentor. The selection process used to pick mentors and mentees was also investigated with the research questionnaire to further understand student preferences and specific needs of those majoring in STEM fields.

The sixty-four (N=64) participants represents a diverse sample of graduate students who pursue undergraduate STEM degrees. Students reported their mentors helped with the following: 1) providing funding, setting goals, providing positive and constructive feedback on their work, and being supportive of ideas which allowed the mentee to follow his/her own ideas for their work. Alternatively, some participants reported unmet expectations by their mentor(s), such as wishing the mentor had: 1) provided more exposure to industry-based tasks, 2) assisted in decision making regarding career decision, 3) presented the mentee with more challenges by encouraging the student to go above and beyond, 4) provided more research opportunities. Such findings indicate that mentors can play a pivotal role in the development of students. These results also demonstrate that mentoring relationships need to be improved for students to receive equal and adequate support. Eighty-four percent of participants reported having more than two mentors. Therefore, having multiple mentors may be more beneficial for students to expand their exposure to multiple mentoring practices while reducing their needs not being met by one mentor. Additionally, 17% of participants reported having five or more mentors. Findings of the present study will be used to create mentoring practices that help students succeed in the STEM fields. This may suggest that students in STEM require more support in order to successfully complete their degrees. Results are being used for suggestions and recommendations for supportive practices that can be implemented in future mentoring programs to help underrepresented groups to successfully achieve degrees in the STEM field under the guidance of a mentor. Mentoring practices should be structured to fully support students specifically in STEM fields facing unique barriers.

Introduction

A total of 48% of bachelor's degree graduates and 69% of associate's degree graduates who entered STEM fields between 2003 and 2009 were no longer employed in their field by spring 2009.[3] About 28% of bachelor's degree graduates and 20% of associate's degree graduates entered a STEM field (i.e., chose a STEM major) at some point within 6 years of entering postsecondary education in 2003−04.[3] Many of these STEM graduates tend not to pursue graduate degrees in STEM. Several tend to pursue graduate degrees in areas other than STEM. The retention rates of graduates in the STEM fields are not thriving as strongly as other fields of study. The purpose of this study is to investigate effective mentoring practices that helped undergraduate students in STEM develop successful career paths into graduate school in STEM fields. Mentoring can effectively contribute to the success of underrepresented students by serving as an integral part of a student's development. Planning and professional engagement with a mentor can help students to be successful in completing a degree in STEM and the pursuing a graduate degree in STEM. Mentoring can be especially essential for underrepresented undergraduate students pursuing STEM degrees. Mentoring relationships provide students with a positive environment that can lead to networking opportunities and career opportunities after graduation, but only recently has research been conducted to fully understand the best practices of mentoring relationships.

Based on previous studies conducted, 82.4% reported positive outcomes for mentees.[6] Students who had a mentoring relationship usually had higher retention rates and GPAs compared to their counterparts who did not receive mentoring.[2] Mentoring has the potential to progress students while nurturing their academic success resulting in student persistence and graduation. Mentoring can lead to personal and professional development. In a recent study, researchers found that 74% of participants believed that their mentoring program led to personal development.[1] For example, a mentee should grow personally through a mentoring relationship by gaining confidence, communicating more effectively, and becoming more knowledgeable among other growth factors. Further, researchers suggest that collaboration, shared decision making, and systematic thinking are important elements in a collaborative mentoring relationship.[1] It is important to develop effective mentoring relationship elements that cater to underrepresented students pursuing a degree in the STEM fields. Therefore, the present research study was designed for underrepresented graduate students in STEM fields to provide feedback on their mentoring experience during their undergraduate program. Based on findings, this study will develop an effective framework for a mentoring program that will foster the mentor-mentee relationship and lead to the successful development of and completion of degrees for students in STEM fields.

Theoretical Framework

Prior researchers advocate for role models to ensure student success.[4] Role model observation and opportunity for interaction supports the concept of self-efficacy in learning for students. Career counselors often conceptualize student persistence and completion with Bandura's self-efficacy

model. The self-efficacy of students increases when role modeling is provided to support the learning experience.[4] This theoretical framework engages students in learning through role-modeling; thereby, promoting student self-efficacy. This framework is central to the present research study and its implications for mentoring practices. Also, prior research was completed by the center for advancing faculty excellence(CAFÉ) to capture data on the best practices of successful mentors. This prior research study surveyed mentors who were recipients of the US presidential awards for excellence in STEM mentoring. Survey results from the presidential award winning mentors revealed the top five mentoring practices most commonly used as shown below.[7] Twenty-five recipients of the Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (PAESMEM) participated in this study. PAESMEM recipients are selected for the award by demonstrating excellence in effectively mentoring underserved individuals in STEM fields over a period of five years or more. The participants were provided with a 22-item open-ended survey and the findings provided information to develop a survey with open- ended questions along with closed-ended questions used for rating mentoring practices. The below diagram displays the top mentoring practices from previous work as follows: dedicated approach to mentoring, opportunities as provided by the mentorship, standards developed in the mentoring relationship, support provided and mutual respect in the mentoring relationship.

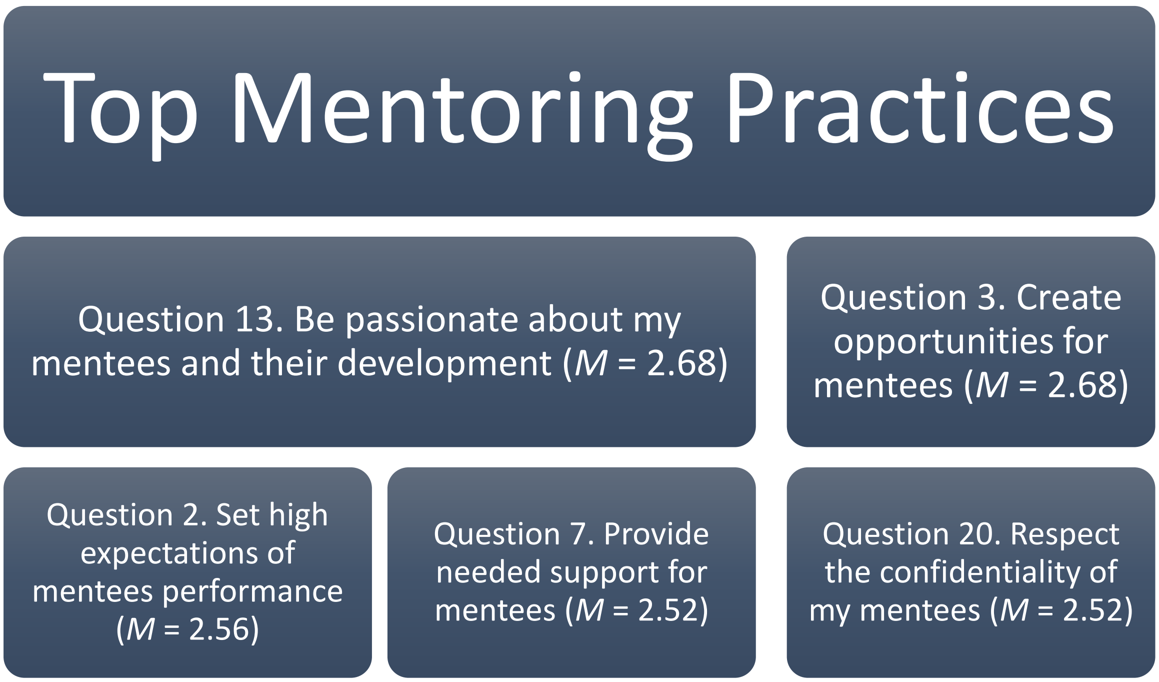

Figure 1 Top mentoring practices as used by presidential award winning mentors

Additionally, these results have helped to guide the development of a new, comprehensive model describing specific mentoring processes that are effectively used by mentors. The model will serve as guidance to mentors on specific practices that can be used with their mentees who are underrepresented in STEM fields.

To further investigate the effectiveness of specific practices used by mentors this research study designed an experiment to collect data from mentees to determine which practices were currently used by their mentors. Also, the research study was designed to compare practices currently being used by mentors to the mentoring practices most commonly used by the recipients of the US Presidential Award for excellence in mentoring.

Methods

The research participants used in this research study consisted of STEM graduate students who reported being mentored during their STEM undergraduate program. The sample size for the study included sixty-four (*N*=64) students presently in a graduate program. A 22-item survey was administered to the participants. Seventy-eight percent of participants were from underrepresented groups and 49% identified most with Black or African-American (see figure 2).

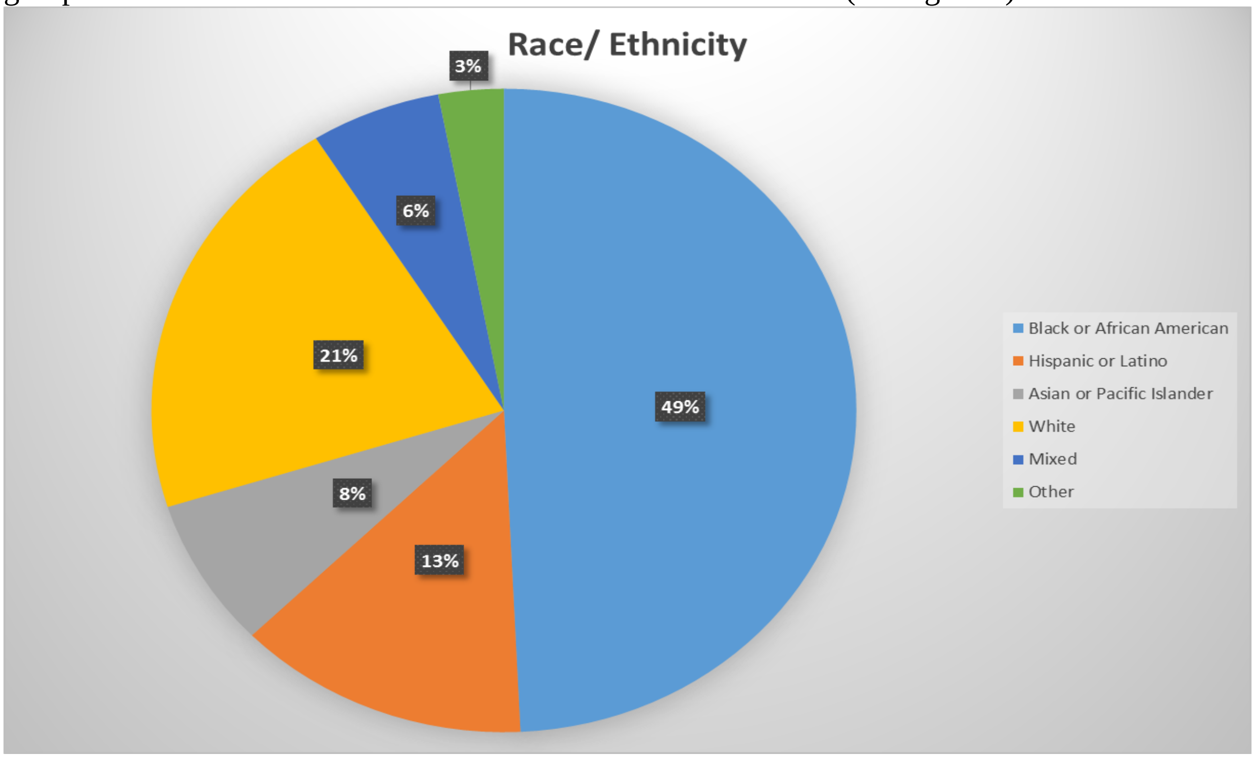

Figure 2. Race/ ethnicity of participants

Additionally, the researchers gathered information from student participants (i.e. mentees) pertaining to their experiences of institutional practices, procedures, and policies in the following key areas using a 22-item survey:

1. Establishment of mentoring programs;
2. Selection of mentors and mentees for mentoring programs;
3. Mentoring programs structure (e.g., frequency of meetings);
4. Program elements in mentoring;
5. Mentoring program activities (i.e., workshops, one-on-one training, worksheets, etc.);
6. Advising for mentoring program; and
7. Additional areas that evolved during the research investigation process.

The survey included questions about the student's mentoring program in their undergraduate institution, their experience, and how the mentor was selected. Participants were also asked to make selections based on a Likert scale of well, very well, exceptionally well, or not applicable based on the degree to which he/she believed their mentor(s) performed various mentoring practices.

Results

The responses provided by the participants to the qualitative open-ended questions on the survey revealed several common emerging themes. For example, when asked to describe what factors were used to select a mentor student participant responses were as follows: 1) professionalism of the mentor, 2) previous advising experience with mentor, 3) person demonstrated consideration for the student in given situations, 4) person was eager to share information to assist with pursuing degree, 5) common research interests with the mentor, and 6) work ethics of the mentor. Common activities reported among participants based on assistance received from the mentor included the following items: 1) mentor assisted with setting goals, 2) mentor provided positive and constructive feedback on assignments, 3) mentor demonstrated respect for ideas, and 4) provided financial and emotional support.

Also, the participants rated the degree to which they believed their mentor(s) performed each practice shown on the survey below using the following Likert scale: Well=1, Very Well=2, and Exceptionally Well=3. The mean for each survey item is provided below in Figure 3.

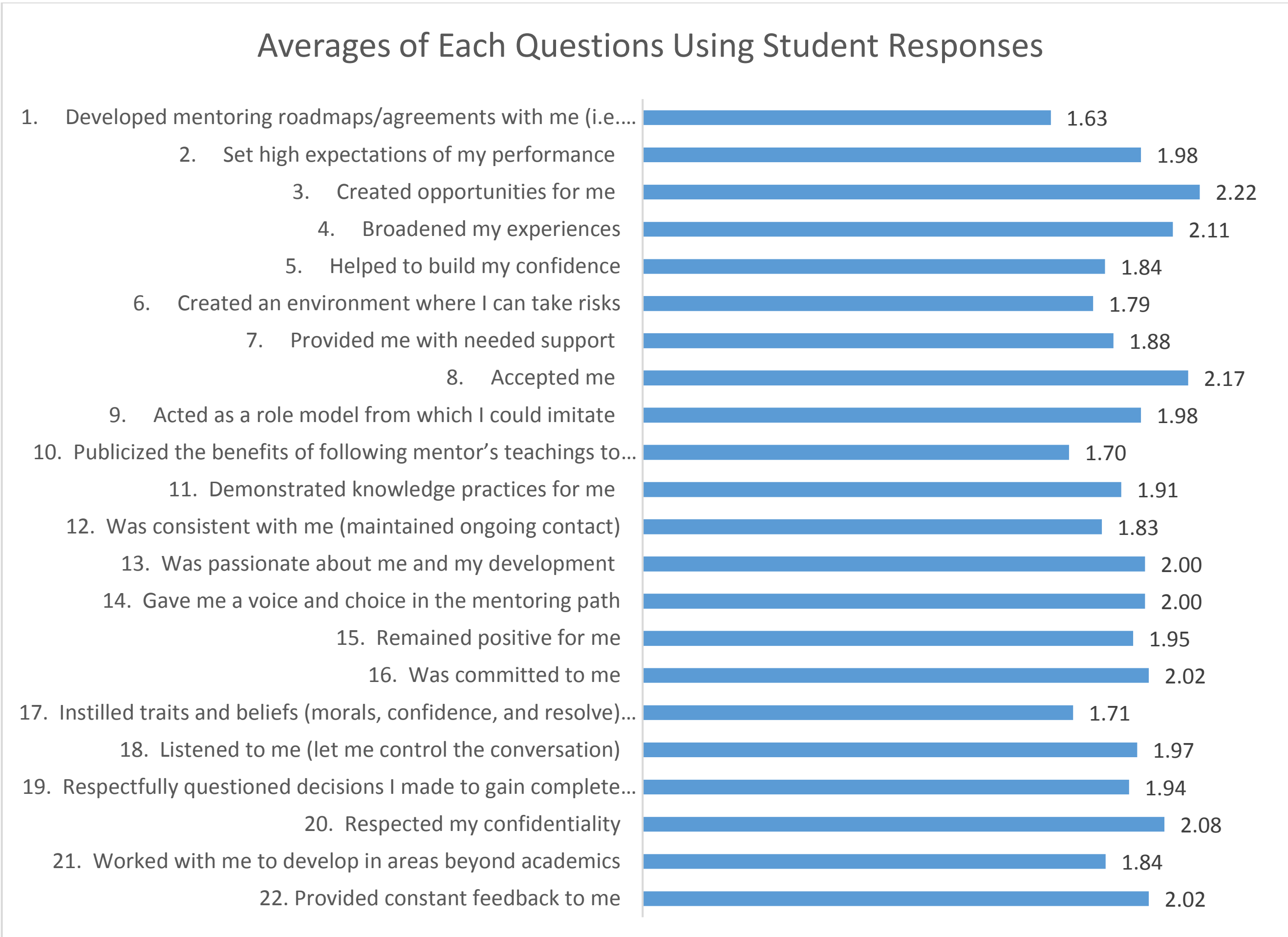

Figure 3. Averages of each question as rated by participants

From the average mean values from each question, Question 3 (created opportunities for me), question 4 (broadened my experiences), and question 8 (accepted me), displayed the highest mean values.

Discussion

Overall, the results indicate that having a mentor is beneficial to students pursuing STEM fields. The participants used various factors such as professionalism, common research interest, and work ethic when choosing a mentor. Such factors identify that mentor characteristics, such as professional identity and specific field of work contribute to mentees' decision-making process. It is important for the mentors to also display professional behaviors as they serve as role models for many mentees. Common research interest and strong work ethic may be important in keeping the mentor-mentee relationship long-lasting and beneficial, by providing the mentee with opportunities within their shared research concentration. Besides choosing a mentor, it is important that the mentor provide the mentee with help in various ways to help the student succeed. Participants reported that their mentors helped them succeed by setting goals, providing positive and constructive feedback, and prioritizing the initiation and development of respect, among other items. Respect seems to be a key factor guiding and sustaining the mentor-mentee relationship. Additionally, mentors that provide constructive and positive feedback help the mentee to advance and grow within their studies. It is also important for mentors to set goals and objectives for the mentee to keep them on track to thrive in their respective STEM fields. Mentees can learn what to expect in their respective STEM fields from mentors as derived from the mentor's unique experiences. The results of this study reveal cooperation between the mentor and mentee responses. The study shows that the most highly related best practice of mentors is creating opportunities for their Mentees.

The opportunities provided to the undergraduate mentee was an essential pathway to graduate school. Such opportunities can provide research career opportunities while enrolled in undergraduate programs and upon graduation. A mentor has the potential to enrich the mentee's experiences by revealing career pathways in industry or graduate school in STEM fields. Undergraduate students are often new to STEM fields, unaware of opportunities, and often can be intimidated by the overall, independent collegiate experience. Therefore, it is the responsibility of the mentor to support students in STEM to identify their strengths, overcome their limitations, and to share with them opportunities for professional growth. The mentee should feel welcome and the mentor should serve as a qualified match for the mentee. Our findings indicate that choosing a mentor, communication, development opportunities, and modeling are key components that impacted the mentees mentoring experience in their undergraduate careers in STEM. Our findings also indicate that mentees benefited greatly from having mentors during their undergraduate experiences. These top themes may have been contributing factors leading participants to graduate school. The emerging themes are as follows: creating opportunities for the mentee, broadening the mentee's experiences, and accepting the mentee. Through our findings and the current literature, mentoring is determined to serve as an incredibly influential and necessary element to student success in STEM fields.

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