

AC 2007-2715: THE IMPORTANCE OF GRADUATE MENTORS IN UNDERGRADUATE RESEARCH PROGRAMS

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The Importance of Graduate Mentors in Undergraduate Research Programs

Abstract

One of the most unsettling problems in higher education has been the dramatic under-representation of African Americans, Hispanics, and American Indians in the nation's engineering graduate schools - especially within the ranks of those who hold PhDs in the areas of science, technology, engineering, and mathematics (STEM). These disparities among the number of whites and minorities who pursue graduate studies are apparent in the findings of Foertsch^[1]. The latter reported that about 30% of whites with a BS degree go on to graduate school, while only 19% of non-Asian minorities with a BS do the same. In 1995, blacks accounted for only 2.0% of all STEM PhDs, Hispanics for 2.5%, and American Indians for 0.3% - even though within the same year African Americans made up about 12% of the U.S. population, Hispanics 10.2%, and American Indians 0.7%.

The Summer Undergraduate Research in Engineering/Science (SURE) program is a ten-week summer research program, at the Georgia Institute of Technology, designed to attract qualified minority students to attend graduate school within the fields of engineering and science and combat the disparities amongst minorities regarding graduate education. We presume that a lack of knowledge, confidence, and support regarding the graduate school intake process are the major contributors to these disparities^[2]. In an effort to address these major contributors, the SURE program provides a support system to its student participants via graduate student mentoring. About 90% of SURE participants have pursued graduate education, which may be attributed to the relationship formed through the mentorship program. Graduate student mentors supply knowledge regarding the graduate school intake process and help bolster SURE student participant confidence through one-on-one mentoring and group activities. An 11.5% quality rating increase occurred from 2005 to 2006 in the graduate mentoring program. Information about mentoring techniques and group activities used in the SURE program, during the summer of 2006, that account for this increase is presented.

Introduction

The SURE (Summer Undergraduate Research in Engineering/Science) program was established in 1992 to expose minority students to research in engineering, applied science, and electronics packaging, and to increase their interest in graduate study. The program is conducted in cooperation with the Colleges of Engineering, Sciences, and Computing at the Georgia Institute of Technology and is funded by the National Science Foundation. Key elements of the SURE program include^[2]:

- Ten weeks of research in engineering (electrical, aerospace, chemical, civil, computer, environmental, industrial, mechanical, or materials), applied science (physics, chemistry, biology, or mathematics), and electronics packaging
- Student participant pairing with both a faculty advisor and a graduate student mentor
- Weekly seminars on emerging research in engineering/science fields from the faculty
- A competitive monthly stipend as compared to that of a summer internship in industry
- Lodging, meals and a travel allowance for student participants
- Local industrial research site visits
- Oral and written research project summaries prepared by the student participants
- Social interaction between the student participants and their graduate mentors
- Program evaluation by the student participants

Within these key elements, interaction among student participants and their graduate student mentor, along with the program evaluation by the student participants during the 2005 and 2006 program years will be addressed.

Graduate Mentoring

To assist student participants in the transition between the undergraduate and graduate experience, they are paired with a graduate mentor. The main goal of this relationship is to aid the student participant in learning how to communicate in a graduate environment, along with increasing their knowledge base and confidence level, as well as enhancing their support system relative to the graduate school intake process. It has been established in the literature that peer mentoring is effective in meeting these goals^[3]. To ensure a cohesive research experience undergraduate students are provided graduate mentors that are advisees of the faculty sponsor whenever possible. In instances when the faculty member advises no minority students for selection as graduate mentors, the mentors are selected from a group of volunteers from the graduate minority student body located at the institution.

Graduate Mentor Pairing

The appropriate pairing of graduate student mentors and SURE participants is a vital aspect of establishing strong mentoring relationships. During the 2005 SURE program the SURE Program Coordinator was solely responsible for the pairing of student participants with graduate student mentors. However, in the 2006 SURE program, graduate student mentors were given the opportunity to select student participants to mentor. Selection was based upon evaluation of a list that included the student participant's home school, hometown, research area, and faculty advisor. A maximum of two and a minimum of one SURE participant(s) were given to each graduate mentor. Graduate student mentor opinions were solicited in the 2006 SURE program. This increased participation in program activities amongst mentors in 2006 as compared with 2005.

Graduate Mentor Training

The 2005 SURE program year did not provide mentor training. Mentor training during the 2006 SURE program year consisted of an informational meeting. An email announcement preceded the informational meeting. The email briefly stated the goals of the mentoring program and included the following program objective, "...to provide a mechanism to deal with the participants' day-to-day questions and concerns related to general aspects of campus and community life^[4]." The informational meeting, held prior to start of the SURE program, supplied graduate mentors with email contact information for their SURE student participant. Questions about the mentoring program were answered at the informational meeting by the SURE Program Coordinator. At this time graduate mentors were advised to contact their student participants prior to their matriculation to the university. It has been shown in the literature that this type of contact allows the student to feel welcomed and supported and helps to develop an added sense of eagerness in starting the program^[5].

Graduate student mentors were provided with materials to effectively initiate contact with the SURE student participant(s) and the participant's research advisor. Sample contact emails to the SURE student participant and SURE research advisor were supplied within the SURE informational meeting email announcement and may be viewed in Appendix A and B of this paper. Also, a list of "Effective Mentoring Strategies^{[6][7]}" and "Suggested SURE Mentoring Bonding Activities" were included in the email announcement (located in Appendices C and D) to assist the graduate mentor in formulating their mentoring strategy before meeting with the SURE student participant. Materials supplied in the email were reviewed during the informational meeting and questions about the graduate mentoring program were answered by the SURE Program Coordinator.

Relationship Development

Graduate mentors escorted their SURE student participant(s) to their research lab after the 2005 SURE program orientation. This marked the initial face-to-face meeting of the graduate student mentor and the SURE student participant(s). Upon the completion of the initial face-to-face meeting, graduate mentors were encouraged to attend social activities with their SURE student participant(s) to build a mentoring relationship. The social activities included a cookout with other undergraduate research programs at the university and a museum visit. The graduate student mentors were also encouraged to attend the final research presentation(s) given by their SURE student participant(s).

In the 2006 SURE program graduate mentors also escorted their SURE student participant(s) to their research lab following the SURE program orientation. A SURE mentoring mixer was held the evening of the SURE program orientation. The mixer included pizza and beverages. An ice breaker activity was implemented during the mixer that required the graduate student mentors and SURE student participants to create their own nicknames and explain the meaning behind them to the group. This exercise allowed the individuals in the mentoring program to become better acquainted. The SURE Mixer Questionnaire (in Appendix E) titled “Inside the Researcher’s Lab”, based upon the television program *Inside the Actors Studio*^[8], granted both the graduate student mentor and SURE student participant(s) an opportunity to develop a personal relationship. Relationships were formed through the interviewing process within this activity. Other social activities during the 2006 SURE program year included a cookout with other undergraduate research programs at the institution, attendance to a baseball game, and a visit to the aquarium. Professional activities were also promoted that encouraged the graduate student mentors to assist the SURE student participants in editing their final research papers and practicing their oral presentation(s). Graduate student mentors were also invited to attend the final research presentation(s) given by their SURE student participant(s).

Assessment and Evaluation

Evaluation of the SURE program was accomplished through paper surveys^[9]. The surveys consisted of a 13 question pre-program survey and a 25 question post-program survey (in Appendix F) that queried the SURE student participants about their undergraduate experience, SURE, and their accomplishments since participating in the program. The pre-program survey was administered to the student participants during the first week of the program at the orientation session by the SURE Assessment Director. Results from the pre-program survey determined the student participant’s thoughts about attending graduate school and are beyond the focus of this paper.

Post-program survey results determined the student participant’s thoughts about the SURE program quality and will be discussed here. The post-program survey was

administered to the student participants by the SURE Assessment Director during the last week of the program. SURE 2005 and 2006 program assessment results included 22 students each. SURE student participants were asked to rate the program using a quality rating scale of one = excellent, two = good, three = fair, and four = poor. Mean values and standard deviations were calculated by the SURE Assessment Director based upon this rating system. Table 1 displays the mean and standard deviation values obtained from the post-program survey for the 2005 and 2006 SURE program years. Mean quality rating for “Experience Gained from Research Project” increased by 9.09% in 2006 when compared with 2005. According to the “Helpfulness of Social Mentor” quality rating, the mean graduate mentoring program quality increased in 2006 by 11.5% when compared with 2005. The “Overall SURE Program Organization” quality rating displays a 12.5% increase in organization of all SURE program components. Quality measurements were obtained from questions 5, 6, and 10 on the post-program survey (in Appendix F).

Quality Rating (n=22)	SURE 2005 Program Year		SURE 2006 Program Year		% Difference Between Mean Values for Years 2005 to 2006
	Mean	Standard Deviation	Mean	Standard Deviation	
Helpfulness of Social Mentor	2.00	0.866	1.77	0.922	11.5 %
Experience Gained from Research Project	1.21	0.412	1.32	0.568	9.09 %
Overall SURE Program Organization	1.83	0.711	1.6	0.503	12.57%

Table 1: Statistical Results of the SURE Graduate Mentoring Program

Conclusions and Recommendations

New approaches were carried out in the mentor pairing process along with the mentorship training and relationship development in the 2006 SURE program year. Most SURE student participants responses during the 2006 SURE program year showed improved results regarding the quality of the mentorship program, research experience obtained, and overall program organization as compared to that of the 2005 SURE program year.

Further analysis should be carried out to determine the effectiveness of each graduate mentoring approach presented. This may be accomplished through quality assessment techniques such as surveys and exit interviews of the graduate student mentors and the

SURE student participants. These quality assessment techniques will be included with that of the current pre and post-program surveys to provide more improvements to the mentoring program.

Hopefully work presented by this study will be incorporated in other undergraduate research programs to aid in the improvements of the overall program quality.

Acknowledgements

The authors would like to express their gratitude to the National Science Foundation (Grant Nos. EEC-0453295 and EEC-9402723) for their financial support of the SURE program. Gratitude is also extended to Mrs. Jill Auerbach the SURE Assessment Director for her assistance with the proctoring and statistical analysis of the SURE assessment surveys.

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Appendix A: Sample of SURE Mentor Initial Student Participant Contact Email

Hello *SURE Participant*,

Congratulations on being accepted into the SURE 2006 program. My name is *SURE Mentor's Name* but please feel free to call me *SURE Mentor's nick name*. I am a fourth year Ph.D. Electrical Engineering student at the Georgia Institute of Technology. I have been assigned as your mentor for the summer. I am here to help answer any question you may have about life at the university or the city in general. As a previous participant in the SURE program I know that you have a lot of great things to expect this summer.

I will see you on *SURE Participants Date of Arrival* at the SURE opening reception unless you will be arriving in the city later, if so please let me know. I see that you are working with *SURE Advisor's Name* this summer and her focus is Intelligent Control Systems is this also your area of research interest? Well, if you have any questions before you arrive in the city just let me know. I wish you safe travels and will see you soon.

Take Care,
SURE Mentor

Appendix B: Sample of SURE Mentor Initial Student Participant's Research Advisor Contact Email

Hello *Dr. SURE Advisor*,

My name is *SURE Mentor* and I am a fourth year Ph.D. Electrical Engineering student here at the Georgia Institute of Technology. I have been assigned to mentor your SURE student *SURE Participant's Name* for this summer. Although, my mentor responsibilities are primarily of a social focus I am very much interested in learning about the overall goals and major aspects of *SURE Participant's Name* summer research project. I believe that knowing this information will help me better meet *SURE Participant's Name* mentorship needs. So, if you could please provide me with a brief summary regarding their research project I would greatly appreciate it.

Thank You,
SURE Mentor

Appendix C: Effective Mentoring Strategies

Mentor Do's!

Be available. (Stay in contact with your mentee on a weekly basis)

Always be punctual.

Discuss your student's goals during your first encounter.

Talk about mentoring. (Ask your mentee if they have participated in a mentor program (as a mentor or mentee) before and inquire about what they learned from it.)

Strive for mutual respect.

Be an encourager.

Show attention and concern by being a friend

Let your mentee know when you notice their individual growth.

Inquire about your student's mentorship expectations.

Be an excellent role model.

Mentor Don'ts!

Don't do the project for the student.

Don't forget communication means listening. This means that you shouldn't be constantly lecturing your student.

Don't act as a professional counselor.

Don't assume that your mentee is interested in everything that you enjoy.

Don't become discouraged if you don't find an immediate connection with your mentee. It often takes time to become comfortable when creating new relationships.

Appendix D: Suggested SURE Mentoring Bonding Activities

Suggested Mentor - Mentee Bonding Activities:

Go to a Movie

Go to the Campus Recreational Center

Team up with another mentoring group and have an outing

Go Shopping

Play a Card Game

Play a Board Game

Go out to Eat

Give them a tour of your research lab

Introduce them to the Music Listening Room at the university

Take a Summer Fun Summer Course Together
(i.e., drawing, yoga, pottery)

Introduce them to individuals within your department if they are interested in your research area.

Find their favorite outing in Atlanta and visit it together.

Go to the Craft Center at the university

Create a Book Reading Club amongst the other mentoring pairs

Assist in editing their research paper

Listen to their research presentation

Appendix E: SURE Mixer Questionnaire

SURE Mentor/SURE Student Participant Inside the Researcher's Lab Questions

What is your favorite word?

What is your least favorite word?

What are you passionate about?

What disgusts you?

What sound do you most enjoy?

What sound do you hate?

What profession other than what you are currently pursuing would you like to attempt?

What profession would you not like to participate in?

Appendix F: Post-Survey

2005-2006 Summer Undergraduate Research in Engineering/Science (SURE) Post-Program Survey

Quality of the following program components

	Excellent (1)	Good (2)	Fair (3)	Poor (4)
1. SURE housing arrangements				
2. Assistance with travel arrangements to the city				
3. Assistance with travel arrangements from the city				
4. Clarity of SURE program objectives				
5. Overall SURE program organization				
6. Helpfulness of social mentor				
7. Assistance with research from faculty advisor				
8. Guidance with research from lab graduate student				
9. Availability of graduate student(s) from your lab				
10. Helpfulness of the program coordinator				
11. Helpfulness of the program director				
12. Clarity of research project objectives				
13. Experience gained from research project				
14. Quality of research facilities used for my project				