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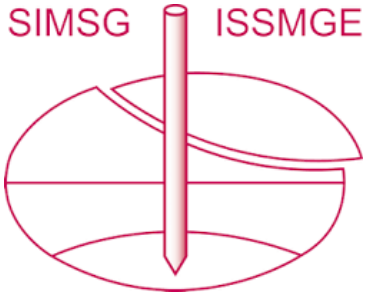

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Graduate Student Perceptions of Mentoring: A Pilot Case Study in the Geotechnical Graduate Student Society at UC Davis

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ABSTRACT: Although sometimes treated synonymously in graduate school, advisors and mentors have distinct roles. Students require different types of guidance in their development from how to build a professional network to how to handle bias in the workplace to balancing a family and graduate school. As graduate student backgrounds increase in diversity, it is unlikely one individual faculty member will be able to meet all the mentoring needs of a student. This paper explores the practices of a geotechnical graduate student group in the U.S., where the activities of a graduate student organization working in tandem with three research centers provide an array of professional development opportunities, including mentoring experiences. A survey was administered to capture the experiences of graduate students in the organization. Results are presented and summarized, targeted at exploring the types and degrees of mentoring interactions and identifying key contributors to training in different categories. Findings emphasize the role of the advisor but also point out that there is always at least one more resource of mentoring in each category thus pointing out the importance of (a) providing opportunities for interactions and (b) an open culture that promotes them.

Keywords: mentoring, professional development, ladder mentoring, graduate students, survey

1 Introduction

Recently research into mentoring practices for engineering graduate student has increased (e.g. Ahn & Cox, 2016; Fowler, 2017; Pelegrino et al., 2015). Many studies target mentoring practices for underrepresented populations (gender, ethnicity, and race) and international students.

Most graduate programs lack a formalized mentoring structure. However, there are still various resources available to students that enhance their graduate experience, contribute to their success in graduate school and prepare them for successful careers in industry and academia. Numerous questions pertain to how these functions are achieved, the key contributors, how the students perceive them, and how they can be enhanced.

The goal of this paper is to present and analyze results from a pilot study on the impact of the various resources available within one geotechnical graduate program on the mentoring experiences of graduate students. A survey was designed and conducted towards assessing current geotechnical graduate student experience. For the purpose of this survey, mentoring was defined as a professional relationship in which an experienced person (the mentor) assists another (the mentee) in developing specific skills and knowledge that will enhance the less-experienced person's professional and personal growth. This interaction can occur between an advisor and a student, a faculty member and a student, or two students. This paper presents a description of the studied graduate student population and program, followed by an overview of the survey. Selected results are presented and conclusions identify which functions contribute most to enhanced graduate student experiences. The paper concludes with a discussion of future work.

2 Mentoring in Graduate School

Graduate studies serve by definition a dual purpose: deepen technical knowledge and prepare students for the workforce. These functions develop beyond the classroom in ways that are still not strictly formalized. Studies (e.g. Cameron & Woods, 2016) frequently acknowledge that faculty historically enter their profession without specific or formal training in how to train others. Cameron & Woods (2016) point out that as a result, there is a great variety of knowledge and expertise that shapes professional development activities in higher education institutions.

Most universities offer a multitude of professional development resources designed for graduate students that go beyond the technical or thematic training typically provided by the advisor or Principal Investigator. Such resources may be located under programs of the office of graduate studies, centers for international students, and teaching centers. Universities also offer professional development series for future professor workshops (e.g. Professors for the Future program at UC Davis), writing retreats, and work-life-balance workshops. Regardless of how vast the number and types of these resources are, it is usually up to the graduate student to identify and pursue such opportunities. However, graduate students may not know early in the process what they need to be: 1) successful and balanced and 2) better prepared for the workforce (academia or industry). Individual graduate programs often do not include formal mentoring components but they may inform graduate students about available opportunities. Resources for graduate students may be underutilized due to timing/frequency (e.g. too many on-campus events over the duration of one week, the overwhelming barrage of information through which students receive information (e.g. blogs, twitter threads, general online resources etc.), or a lack of priority when these activities are compared to more urgent timelines (e.g. assignments, exams, papers).

The geotechnical group at UC Davis has been steadily growing over the last 10 years and has succeeded in securing funding for two major research centers (the NHERI Centrifuge Facility and the NSF Engineering Research Center for Bio-mediated and Bio-inspired Geotechnics (CBBG)), graduating Ph.D. students that have continued their careers in academia as Assistant Professors, and recruiting and retaining highly motivated and productive graduate students. In this paper, we posit that a key aspect of the group's success is a culture of mentoring and support that runs through the professional, educational, and affective operations involving UC Davis geotechnical faculty and students. Despite anecdotal data supporting our hypothesis, we have had little formal evidence and data. As such, herein we explore the practices of the group wherein a graduate student organization and its activities, alongside with the operations of individual research groups and research centers provide ample opportunities for graduate students and promote an overall open culture such that the graduate students can continuously develop the skillsets necessary to succeed in graduate school and beyond.

3 Graduate Student Development in UC Davis

For the purpose of this work we identify the various sources of mentoring that graduate students can receive beyond the advisor-advisee interactions with their advisors and their research group meetings. In this section sources of graduate student development are summarized and described.

3.1 The Geotechnical Graduate Student Society (GGSS) of UC Davis

In 2007, graduate students in the Civil and Environmental Engineering Department, at the University of California, Davis established the Geotechnical Graduate Student Society (GGSS) at UC Davis, a student-run organization designed to enhance and broaden their technical education through unique educational, professional and social opportunities. The formation of GGSS was the result of discussions amongst faculty, students, and industry practitioners who realized that technical background is only part of what it takes to become a successful practitioner or researcher in geotechnical engineering (Montgomery et al., 2013). The core goal of the student-run GGSS is to promote scholarship, service, leadership, and social networking for the geotechnical group at UC Davis with the intent of fostering collaboration throughout the group and provide opportunities to enhance the education and professional development of its members. To achieve these goals, GGSS sponsors several types of activities including seminars, field trips, outreach events, social events, and the annual Round Table event. All civil engineering graduate students at UC Davis with an emphasis on geotechnical and pavement

engineering are automatically admitted to the group. GGSS averages 30 active members each year, in addition to several visiting scholars, postdoctoral students, select undergraduate students and "friends" who participate as honorary members (Montgomery et al., 2013). The board of directors (five annually elected officers and a non-voting faculty advisor) makes all decisions about the group's operations and provides leadership in executing all activities. The group seeks to broadly maximize the graduate experience while focusing on two fronts: (a) enhancing education through connections with professionals outside of UC Davis through seminars, field trips and an annual institute, which is a daylong or longer workshop led by an invited speaker covering topics outside of the geotechnical graduate curriculum, and (b) career development via participation in conferences and other professional events as well as the annual Round Table, a daylong open house where approximately 50 invited professionals engage directly with graduate students who present their research through oral presentations and poster sessions. This event helps students polish their presentation skills and provides a forum for networking and collaboration between geotechnical professionals, faculty and graduate students. Many students have been introduced to their future employers at this event, with about 85 percent of the program's graduates hired by companies/organizations who attend the Round Table. The Round Table event uniquely bridges the academic-industry gap and opens necessary conversations with professional geotechnical engineers to help refine research goals and inspire new projects based on the current needs of the industry (Montgomery et al., 2013).

3.2. Research Centers (CGM / CBBG / UCPRC)

The UC Davis Geotechnical group is the home of the three different research centers described in Table 1. The Center for Geotechnical Modeling (CGM) and the Center for Biomediated and Bioinspired Geotechnics (CBBG) have developed a Ladder Mentoring Model (LMM) for mentoring graduate students in academic environments that does not increase demands on center personnel (Bronner et al., 2018). The LMM combines ideas (or elements) from several existing mentoring models and relies on six core principles. These principles are: (1) providing a sustainable structure with clear expectations, (2) tailoring mentoring to needs of the individual, (3) leveraging resources generously, (4) promoting an inclusive culture, (5) encouraging consistent assessment, and (6) building networks that expand beyond the borders of the institution. Students receive guidance from a variety of mentors with different areas and levels of expertise or experience. Bronner et al. (2018) provide a brief overview of the UC Davis LMM and explain how it is integrated into three critical areas of graduate student development: technical training, professional skills, and educational outreach. This discussion will not be repeated herein for brevity.

Table 1: UC Davis Geotechnical Organizations that provide professional development opportunities for graduate students (after Bronner et al., 2018)

Organization	*Purpose*
CBBG (Center for Bio-mediated and bio-inspired geotechnics)	Transform geotechnical practice by developing technologies that leverage natural biogeochemical processes or leveraging principles/functions/forms from natural analogs (i.e., bio-inspired), resulting in more efficient and sustainable solutions
CGM (Center for Geotechnical Modeling)	Provides access to world-class geotechnical modeling facilities to enable major advances in the ability to predict and improve the performance of soil and soil-structure systems affected by natural hazards
UCPRC (University of California Pavement Research Center)	Dedicated to providing knowledge, the Pavement Research Center uses innovative research and sound engineering principles to improve pavement structures, materials, and technologies.

In addition to training and developing skillsets pertinent to disciplinary topics of each center, students voluntarily participate in outreach activities as well. These activities include providing several tours of the facilities (mainly the CGM) each year for K-12 (kindergarten to 12th grade) student groups including Cub Scouts, summer camps and field trips from local elementary, middle, high schools, and community colleges. The tours are customized based on the audience with a time frame ranging anywhere from two hours to a full day and the group sizes range from 8 to 60 students. These activities are constructive

and rewarding for the graduate students and help promote geotechnical engineering to the local community as well as help the graduate students practice communicating their research to a broad range of audiences.

4 Design of Survey

A survey was designed to assess current geotechnical graduate student experience. Survey questions are listed in Table 2; some questions were adaptive based on prior answers. For the purpose of this survey, as previously mentioned, mentoring was defined as a professional relationship in which an experienced person (the mentor) assists another (the mentee) in developing specific skills and knowledge that will enhance the less-experienced person's professional and personal growth. This can occur between an advisor and a student, a non-advisor faculty member and a student, or two students.

The questionnaire objectives were to: (1) collect the demographics of the student study group and their incoming (past affiliations) and desired outcome (target degree) (Q1 to Q5), (2) determine the types and degrees of mentoring interactions they experienced in the program (Q6 to Q11), (3) define the areas in which mentoring occurred (leadership, time management, writing, etc.), (4) identify the engagement with the GGSS and its activities (Q12 to Q20), (5) investigate the perceptions that students have of their mentor/mentee experiences, and lastly (6) solicit their input on future undertakings (Q21 to Q26). A pilot version of the questionnaire was sent to four graduate students to help identify any gaps or issues in the questions. The survey was then deployed (January to March of 2018) to 46 current graduate students. The survey was intentionally not sent to any alumni. As such the study assesses a static status of graduate student perceptions of mentoring and not the development of mentoring opportunities and perceptions through the years.

Table 2. Survey questions and indicative potential answers

Q1. What is your relation to the UC Davis graduate geotechnical department? >> *Potential answer: Current student* **Q2.** What is your expected graduation date? **Q3.** What is the highest-level graduate degree you plan to earn from UC Davis? >> *Potential answer: Post Doc* **Q4.** What is your expected graduation date? **Q5.** Please list your previous institutions i. Undergraduate ii. Undergraduate - if you attended more than one university iii. Masters - if applicable iv. PhD
Q6. Who is/are your advisor(s)? [*Check all that apply*: Advisor(s) Name(s): (Abrahamson, Boulanger, Bronner, Dafalias, DeJong, Harvey, Idriss, Jeremic, Kutter, Lucia, Martinez, Ziotopoulou, other]
Q7. How often do you meet with your advisor? [*check one*: Weekly, Biweekly – every other week, Once a month, As needed]
Q8. How often do you have mentoring interactions with each professor (other than your advisor)? [*all faculty listed and then check one for each faculty*: Never, Rarely, Occasionally, Routinely]
Q9. For each row, choose the resources (column titles) in which you've received the most training. If you've received no training in an area select N/A, if only one applies then only choose one. *Rows: Oral & Written Communication, Team Management / Conflict Resolution, Other Professional Skills, Thesis / Dissertation, Mechanical Workshop Skills, Centrifuge Skills, Numerical Modelling Skills, Other Technical Skills, Navigating Graduate School, Personal Advice, Career Advice, Time Management Skills* *Columns: Advisor / Advisors, Other Faculty, Research center (CGM, CBBG) & department staff, Other grad students, Non-department grad resources (e.g. campus wide), GGSS Seminars and Round Table, N/A*
Q10. List all of the people you consider your mentors in the Geotech Program.
Q11. List all of the people you would consider your mentees during your time in the Geotech program.

Q12. Are you a member of the Geotechnical Graduate Student Society (GGSS)? *[Yes / No]*
Q13. If yes in Q12: Have you served in a leadership role at any point? *[Yes / No]*
Q14. About how many years have you been active in GGSS? *[Numeric answer]*
Q15. Approximately how often do you attend the GGSS Seminars? [*check one*: Always, As much as I can (more than half the time), About half the time, Sometimes, Never]
Q16. If you are not active in GGSS, or there have been periods of time where you have been less active, what is/was the primary reason?
Q17. How many Round Table events have you participated in? *(Possible answers 0 to 6+)*
Q18. How many outreach events have you participated in? *(Possible answers 0, 1-2, 3-5, 6-10, 10+)*
Q19. How many GGSS field trips have you participated in so far? *(Possible answers 0,1-2,3-5, 6-10,10+)*
Q20. Broadly speaking, where have you encountered mentoring experiences? Check all that apply. [*Options provided: Graduate program at a different institution, Postgraduate career, REU position, Internship, Undergraduate program*]
Q21. How does your experience as a mentor within the UC Davis geotechnical department compare with other mentoring experiences you have had, including those at other institutions?
Q22. How does your experience as a mentee within the UC Davis geotechnical department compare with other experiences as a mentee you have had, including those at other institutions?
Q23. How can your experience as a mentor at UC Davis be improved? How could have your experience as a mentor at UC Davis been improved?
Q24. How can your experience as a mentee at UC Davis be improved? How could have your experience as a mentee at UC Davis been improved?
Q25. If you were to start a GGSS at a different institution what would be the three ingredients necessary? Please elaborate.
Q26. What is one thing you would change about GGSS?

5 Results and Discussion

This section presents results obtained mainly from the first two sections of the survey (Questions 1 to 20). Results from Questions 21 to 26 which were more descriptive are summarized but are not used to draw any conclusions yet as they are the subject of further research.

5.1 Types and Degrees of Faculty-Student Interactions

A total of 44 graduate students and two post-doctoral researchers participated in this survey and answered the questionnaire. Of the 44 graduate students, 33 were PhD students and 11 were Masters students at the time of the survey. Out of the 46 surveyed people, 22 had undergraduate degrees from an institution outside of the U.S.

Forty-two participants, including the post-doctoral researchers, listed one formal advisor, four listed two co-advisors. The majority of the participants indicated that they met on a weekly basis with their advisors (22 responses), a large minority (18 participants) reported meetings on an as-needed basis, while the remainder reported either biweekly or monthly meetings.

Question 8 was designed to identify if students have mentoring interactions with more faculty than their advisor and if yes how frequently. Nine students reported mentoring interactions only with their own advisors (as reported in Q6) and the average frequency of those interactions was described as “routinely”. The remaining 39 students reported mentoring interactions beyond their advisors. More specifically, seven students reported interactions with one more faculty (“occasionally” average reported frequency), three students with two more faculty (“occasionally” average reported frequency), four

students with three more faculty and 21 students with four or more faculty ("rarely / occasionally" average reported frequency). In addition, seven students noted mentoring interactions with staff at experimental facilities (e.g. Center for Geotechnical Modelling CGM or University of California Pavement Research Center UCPRC) as well as with faculty outside of the geotechnical faculty. These interactions ranged from rare to routine with the majority listed as routine. Notably, one student listed another graduate student as an advisor and reported routine interactions with them. Future work will seek to correlate the experiences reported to the types and degrees of interactions reported.

Overall, the results strongly indicate that interactions occur in more than one direction and that students often receive mentoring from three or more faculty members. More interestingly, the mentors are not necessarily the official advisors. It remains to be seen what is the driver behind these relationships, e.g. whether they are intentionally initiated by the advisor encouraging the student to seek mentoring from other faculty or by the student taking initiative towards covering perceived gaps in his/her development. Further research could also clarify whether these mentoring relationships occur more organically in the framework of other pre-existing interactions (in the classroom, during a seminar, during social events etc.) and gradually build up over time.

5.2 Areas and Sources of Mentoring

In Question 9, participants selected their perceived sources of mentoring for a variety of preselected categories that are posited to be important aspects of a students' research or professional development (e.g. team management, oral and written communication skills, navigating graduate school). Figure 1 presents the results in terms of how many people selected each option per category for nine selected categories of skillsets. Amongst the resources identified, the research center and department staff refer to all the resources and functions available within the operations of CGM, CBBG and UCPRC. This includes either day-to-day operations or meetings (either research or planning). Non-departmental resources refer to any resource or activity available either on- or off- campus but not within the geotechnical group. The GGSS category refers to all the operations of the GGSS (see prior section).

Oral and written communication (Fig. 1a) includes all the skillsets pertaining to disseminating knowledge and communicating science with various audiences. The advisors were reported as the main resource for this skillset with other resources receiving approximately equal weights of about 25% of students. Graduate students are the second most selected resource emphasizing the importance of peer-to-peer mentoring and group meetings in which students practice talks and prepare for disseminating their research.

Team management and conflict resolution (Fig. 1b) includes aspects of human resource management which are valuable for building successful careers in academia and practice. In this category results were slightly more scattered indicating the different practices followed within individual research groups, as well as the key role that research centers can play in setting a paradigm for team management. It is notable that 18 students identified no resources on this topic while no students listed non-departmental resources or GGSS-related resources on this topic.

The thesis / dissertation category (Fig. 1c) encompasses all the aspects that pertain to writing and delivering the thesis (MS students) and dissertation (PhD) students. As expected, the advisors were identified as the primary resource, but the appearance of graduate students as a resource for this category demonstrates the collegial nature developed amongst the students and the peer-to-peer mentoring that has developed amongst a portion of the program's graduate students.

Centrifuge skills (Fig. 1d) refer to all the aspects of performing centrifuge model testing, a key strength of UC Davis. 30 students left this question unanswered and those were likely the students who did not perform any centrifuge model testing at the CGM facility. In this category, most training comes from the research center and other graduate students with the advisor playing a smaller role in the training. An interesting finding is that almost all the students identified other graduate students as a resource while in some of the cases the advisor was not listed at all. Bronner et al. (2018) present an extensive study on mentoring particularly for research centers and also draw the conclusion that most of the centrifuge skillsets grow with the help of fellow students and the facility itself. Numerical modeling skills (Fig. 1e) refer to all the aspects of performing advanced computational research. The 23 students who left this question unanswered were students who did not perform any computational research. The advisor seems to be the primary resource in this case followed by other faculty indicating the coverage that faculty collegiality can offer to a body of students.

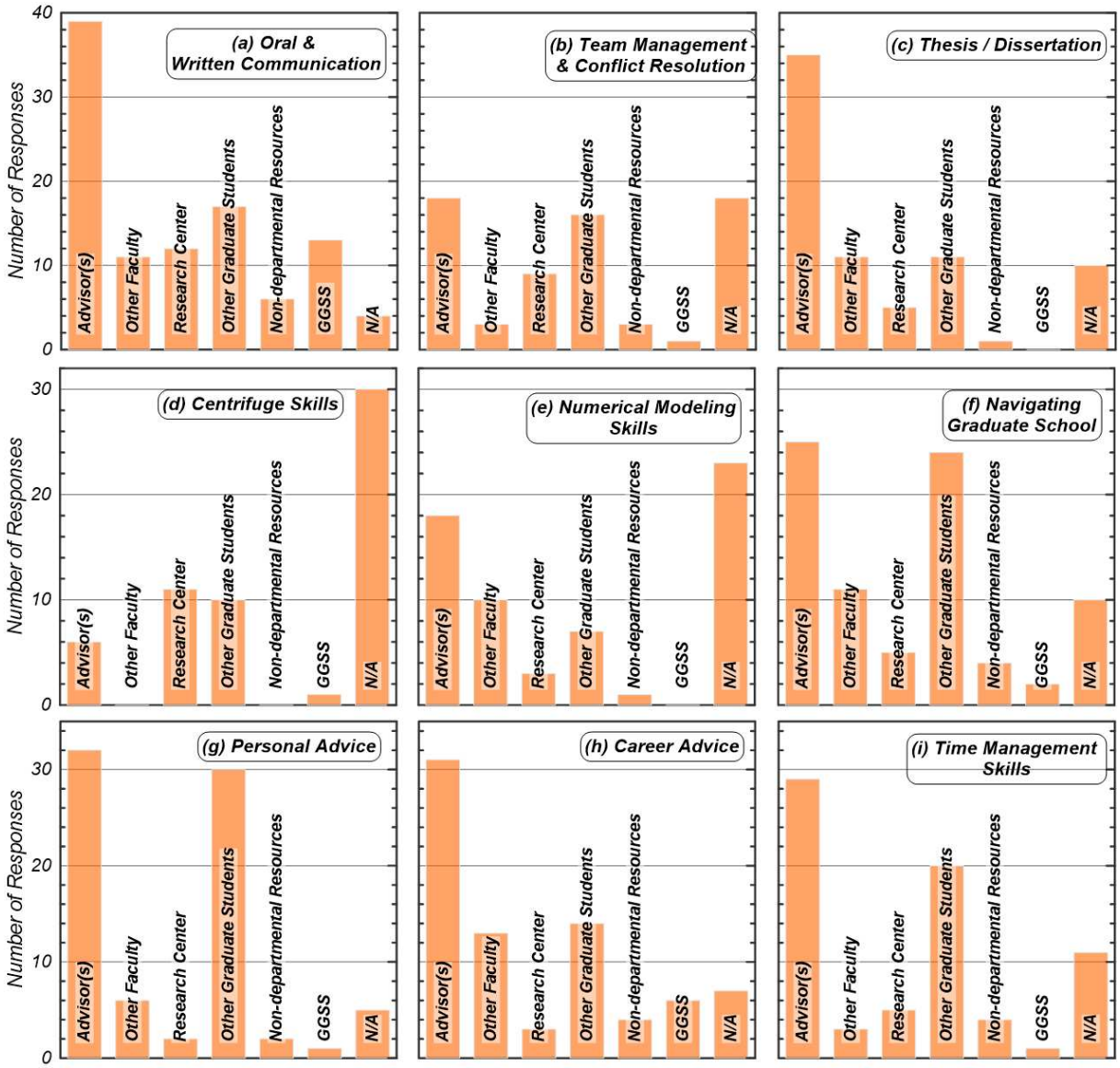

Figure 1. Types and degrees of mentoring interactions with six identified resources of training for nine selected categories of skillsets. Results obtained from Question 9 of survey.

The “navigating graduate school” (Fig. 1f) and “personal advice” (Fig. 1g) categories were listed in order to encompass the skillsets that relate to the life of a graduate student and the components that contribute to its success. In both of these categories the participation of fellow graduate students increased and closely competed with the role of the advisor, indicating that when it comes to more personal conversations, peer-to-peer relationships and potentially friendships can dominate. Interestingly, but not visible in Figs. 1f and 1g, in “navigating graduate school” ten students indicated only other faculty or only other graduate students as their resources. Furthermore, in the resources for personal advice ten students identified their advisor as their sole resource, while 21 identified their advisor in combination with other faculty (6) and predominantly with other graduate students (15). Ten students indicated only other graduate students as their resource for personal advice. The variety of results indicates that students may need sources beyond that of their advisor. More information is needed on which topics students feel comfortable discussion with their advisor, other faculty, and other students. For example, a female student who has a male advisor may seek out a female faculty member to ask them about their experience as an underrepresented group in geotechnical engineering.

The “career advice” category targeted at determining the resources that help students identify career pathways and prepare for those. Advisors stood out here as well as a major contributor and for eleven

students the advisor was the sole resource. Twenty-one students identified their advisor in combination with other faculty (12), other graduate students (6), GGSS functions (2), and non-departmental resources (1). Two students indicated only GGSS-related functions as their sole resource and four students identified other faculty or other graduate students as their sole resource. The range of responses requires additional study, perhaps qualitative approaches, to understand the differences in student experience.

Last but not least, the "time management" category (Fig. 1i) aimed at identifying whether and how students learn this skillset from somebody. In this category the advisors closely competed with other graduate students with eight students identifying their advisor as their sole resource, and 21 identifying their advisor in combination with other graduate students (14), other faculty (2), research centers (4), and non-departmental resources (1). Four students identified other faculty or other graduate students as their sole resource.

Overall, the results strongly indicate that the three key resources for training in all categories are the advisors, the graduate students, and the other faculty. Depending on the skillset, the activities within research centers may also be very influential (e.g. centrifuge model testing); it is positive that these tend to be more technical skillsets. GGSS activities like seminars and the Round Table were not perceived as very influential but future research can explore whether these activities instigate any of the mentoring that comes from other resources (e.g. a student presenting during a Round Table event will prepare with the help of his/her advisor and fellow graduate students but will not necessarily list the Round Table as a resource). Another important conclusion is that peer-to-peer relationships between graduate students are key in their professional development and should be cultivated through professional and social functions.

5.3 Engagement with GGSS

The last set of questions (Questions 12 to 19) sought to identify the degree of engagement of students within the GGSS activities, such that correlations can be later drawn between levels of engagement and perceived mentoring relationships or the development of professional skills. Out of the 45 surveyed students, 40 indicated that they were members of GGSS, with 21 out of these 40 having served in a leadership position (president, treasurer, seminar coordinator, social coordinator, fieldtrip coordinator). Twenty students reported always attending GGSS seminars, 11 attended as much as they can, six sometimes attended, and one about half of them, and seven never. The students who indicated not being active in GGSS either always or occasionally admitted that this was mostly due to being busy with work or being overcommitted on other fronts that coincide with the seminar time but wished they could participate more. The average number of Round Table events attended was two across all the students surveyed. This frequency is reasonable given that the event takes place once a year in March and the survey took place between January and February.

Questions 18 and 19 surveyed the participation of students in outreach events and field trips and Figure 2 summarizes the responses in terms of absolute numbers (Fig. 2a and 2c) and normalized numbers (Fig. 2b and 2d) wherein the number of events reported by students was normalized by the number of years each student reported being in the program (Question 14). More than half of the students have participated in at least one outreach event and one field trip but the numbers are definitely not comparable to those of seminar participation. Taking into consideration that there are about three field trips a year and 6 to 8 outreach events a year these numbers are generally encouraging. Future research on the individual responses across the set questions followed by interviews could help identify whether the numbers of Figure 2 correlate with the students' overall mentoring experience at UC Davis or not.

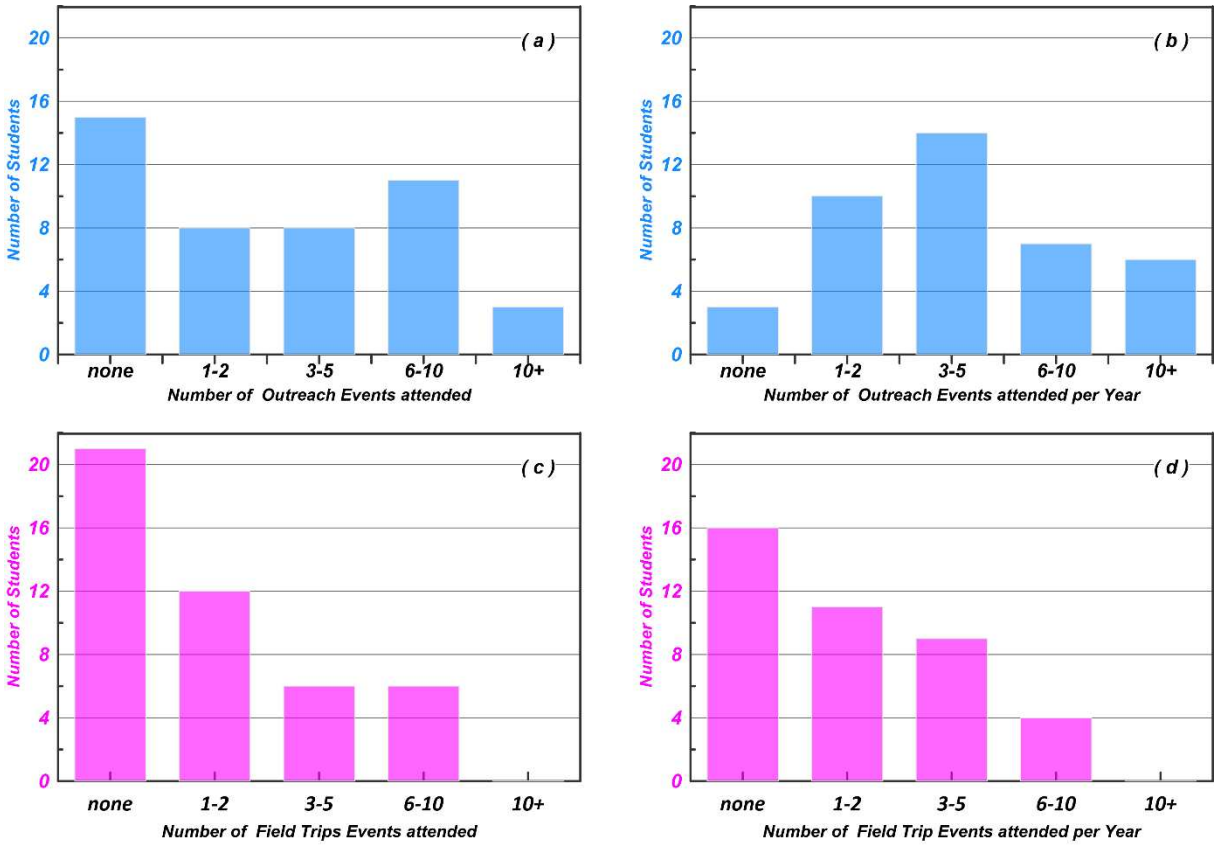

Figure 2. (a) Number of outreach events attended by students who participated in the survey (Questions 18 and 19), (b) number of outreach events attended by students normalized by the number of years of the students at UC Davis, (c) number of field trips attended by students who participated in the survey, (d) number of field trips attended by students normalized by the number of years of the students at UC Davis

5.4. Perceptions of Students

The last set of questions sought to investigate the opinions of students of their experiences and solicit their input for future work and developments within the group. The general sentiment of answers to Questions 21 and 22 was that students appreciate the informal structure of the program and the demeanor of the faculty both of which were characterized as strong contributors to the sense of community. The majority of students also reported that they would appreciate more opportunities to mentor junior students. This emphasizes the importance of Research Experiences for Undergraduates (REU) programs as well as intentional ladder mentoring within research groups. For Question 26 ("What would you change in GGSS?"), the majority of students reported that they would appreciate more interactions with other disciplines as well as more opportunities for interactions across the different research groups.

6 Future Work

Future work can explore various hypotheses about how these relationships initiate and evolve, aiming mostly at identifying key predictors in students' success through graduate school and enhancing identified gaps. Future work can also address ways of deploying our observations to other graduate student bodies as well as industry. The authors currently distinguish the following as agents of mentoring interactions or of at least developing a fruitful ground for mentoring interactions to flourish in graduate student groups and very likely in industry: shared lab space and shared lab offices, faculty culture and relationships, diverse faculty, weekly seminars, and regular social events. Future work should also explore the opinions of alumni with regards to their experiences and seek to study whether and how practices have evolved through the years and how alumni have applied skills and experiences gained from the graduate program in their careers.

This paper outlined some of the key contributors and functions behind graduate student mentoring. The opportunities offered by a student-run organization can provide a foundation for interactions such that mentoring can more organically develop. The authors consider that graduate programs and faculty in particular should: 1) clearly outline what mentoring is, so that students gradually realize that the graduate student experience goes beyond the advisor-advisee relationship, 2) suggest what growth opportunities students should pursue and where to gain the needed skills, 3) encourage interactions among students in the program through social, outreach and field trips, so that they may develop organic peer mentoring relationships, 4) offer a multitude of opportunities for professional growth (e.g. conference participation), and 5) inform students of resources available beyond the narrow reach of one's research group. The authors recognize that while it is certainly challenging to fit all ideas and resources for graduate student development in one program, offering a multitude of diverse opportunities can gradually encourage students to develop a plan tailored to their own needs and aspirations.

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Authors' bios

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Katerina Ziotopoulou is an Assistant Professor in the Civil and Environmental Engineering Department at University of California, Davis. Prior to joining UCD in 2016, she was an Assistant Professor at Virginia Tech for two years. Dr. Ziotopoulou has a Ph.D. in Civil and Environmental Engineering from UC Davis, and a B.S. in Civil Engineering from the National Technical University of Athens, Greece. She teaches undergraduate and graduate geotechnical engineering classes and her research focuses on the performance-based evaluation of liquefaction effects on infrastructure and its mitigation. Dr. Ziotopoulou is also PI/co-PI in projects focusing on understanding mentoring interactions within graduate groups, as well as mentoring international graduate students and women through critical transitions.

Colleen E. Bronner, University of California Davis, USA

Colleen E. Bronner, Ph.D. is an Associate Prof. of Teaching in Civil and Environmental Engineering at UC Davis, where she serves as Department Vice-Chair for Undergraduate Studies. Dr. Bronner has a Ph.D. and B.S. in Environmental Engineering from the University at Buffalo, and a M.S. in Civil Engineering from the UC Berkeley. Her professional interests focus on increasing inclusivity and equity in engineering, development of professional skills in engineering students, and incorporating active-learning styles in undergraduate education. She is the UC Davis Education Lead for a NSF-funded Engineering Research Center, the Center for Bio-mediated, Bio-inspired Geotechnics. Other activities include serving as the faculty advisor of the UC Davis Engineers Without Borders chapter and the newly established UC Davis O-STEM chapter and participation in the American Society of Engineering Education.

Diane Moug, Portland State University

Diane Moug is an Assistant Professor in the Civil and Environmental Engineering department at Portland State University. Prior to joining PSU in 2017, she earned her PhD at the University of California, Davis in geotechnical engineering. She teaches undergraduate and graduate geotechnical engineering classes including Introduction to Geotechnical Engineering, Theoretical and Computational Geomechanics, and Advanced Soil Mechanics. Her research focuses on geotechnical earthquake engineering, particularly subsurface characterization methods and bio-mitigation of liquefaction hazards.