

Empowering Engineering Undergraduates through Faculty Mentorship

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Introduction

The challenges of the college experience, particularly as students transition into it, highlight the importance of a strong support system for students. As part of this support system, mentoring has become a key element in promoting the growth and success of undergraduates, and it has gained attention for offering personalized guidance and fostering a sense of belonging within the academic community [1].

There are many different perspectives on what mentoring encompasses [2] and how to provide it. Some mentoring programs consist of assisting students with technical questions [3], and it can be performed by faculty and advanced peers. Individual tutoring [4] and the Supplemental Instruction program [5] are sometimes described as mentoring models as well, but they appear more as models of knowledge building through peers [6]. Mentoring in terms of research and project direction has also been studied [7, 8]. "Natural" mentoring [9] has also been researched, where instead of planned mentoring assignments, faculty and students connect through their day-to-day interactions. Here, we consider mentoring carried out by faculty and in a much broader sense, which extends beyond the technical and knowledge focus. As the research highlighted in [10] shows, faculty-student relationships are widely recognized as influential factors in student achievement and success, and retention is impacted by the quality of academic advising [11]. This work aims to understand the needs and expectations of students, as well as the perspectives of the faculty involved in a mentoring program in an Electrical and Computer Engineering (ECE) department at the University of Illinois Urbana-Champaign.

Mentoring is an expected component of faculty responsibilities. Undergraduate students across various academic levels are randomly assigned to a faculty mentor. Some students receive their assignment during their first semester, while others may be reassigned later in their program, and transfer students are assigned a mentor upon joining the university. The assignments do not take into consideration whether the mentors' research areas align with the students' specific academic or professional interests. Each faculty member mentors approximately 30–35 students per semester, most of whom remain with the same mentor until graduation. The time devoted to mentoring varies based on mentoring format, i.e. group versus individual meetings, and meeting duration, but faculty may spend up to approximately fifteen hours mentoring students within a four-week period.

Students are required to meet with their assigned faculty mentors once per semester, and failure to meet with their faculty mentor results in a hold on their registration for the subsequent semester. It is up to individual faculty members to determine the mentoring meeting format: one-on-one or

in groups, in person or online. One-on-one mentoring allows for tailored guidance, whereas group mentoring promotes peer learning and networking. There is research that indicates that peer mentoring positively influences student retention and self-esteem [12]. Faculty are also free to determine the duration of the mentoring meetings. The meetings can also cover a broad range of topics in academic and professional development, departmental and university resources, as well as social and emotional topics.

This work presents the findings of the final phase of the corresponding work-in-progress project [13, 14]. In the first phase of the project, three ECE faculty members held one-on-one, in-person meetings with their mentees. In the second phase, several faculty members conducted mentoring meetings in small groups and mixed one-on-one/group format. In the Fall 2025 during the final phase faculty members allowed students to choose their preferred meeting format (group or one-on-one). At the end of the period, the department invited all students to voluntarily participate in an online survey designed to assess their experiences and preferences regarding various aspects of the mentoring process. The survey explores topics discussed during meetings, areas students wished to address, resources provided or desired, and perceptions of meeting duration and frequency, among other factors.

Additionally, faculty members were also asked to complete a corresponding survey to capture their perspectives on mentoring, as well as on the difference between the faculty mentoring program and the departmental advising. This paper presents the findings from the surveys and offers recommendations for improving the efficiency and effectiveness of the mentoring process.

Methodology

A survey for students and a survey for faculty members were distributed in ECE department online after the mentoring period ended in the Fall 2025 semester.

Among all students invited to complete the survey, 214 students participated. The student survey focused on seven main areas: the expectations, the level of support received, comfort in discussing academic and non-academic topics, logistical considerations, stress levels, and suggestions for improvements. Questions Q5-Q15, Q17 and Q20-Q22 were rated on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). Questions Q16, Q18, and Q23-Q26 were designed to be open-ended. Questions Q1-Q4 and Q19 were multiple choice. The survey questions are presented in Table 9 below.

Phase one of this project had already performed exploratory factor analysis (EFA) on all Likert questions, resulting in a two-factor solution, and the scree plot also indicated a two-factor solution. One factor represents a measure of satisfaction with the mentoring experience, while the other (Q21 and Q22) measure stress levels. The model had a Cronbach alpha value of 0.928, exceeding the 0.7 threshold, suggesting high reliability of the model. The goodness-of-fit test resulted in a Chi-Squared value of 88.97 with 43 degrees of freedom and a significance below 0.001, indicating a strong model fit.

In this final phase, statistical analyses of the survey data including independent-samples t-Tests, Analysis of Variance (ANOVA), and Chi-square tests were conducted using IBM SPSS [15] to

determine if there were significant differences in responses.

Among ECE department faculty, 21 members participated. The survey questions for faculty are presented in Table 10.

Findings

This section presents the results of the two distributed surveys. Table 1 presents descriptive statistics of the student survey questions evaluated on Likert scales. The faculty survey did not include any Likert questions.

	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q17	Q20	Q21	Q22
μ	3.46	3.79	3.85	3.71	3.64	3.73	3.58	3.66	3.41	3.19	3.49	2.86	3.93	3.07	2.79
σ	1.02	0.97	0.97	0.99	1.12	1.04	1.10	1.08	1.07	1.14	1.12	0.67	1.22	0.90	0.94

Table 1: Descriptive statistics for survey questions.

Findings on preferred meeting format

While 76% of faculty decided not to conduct group meetings in favor of only one-on-one meetings, the rest of them offered students the option of participating in either in-person individual meetings or small-group meetings (up to five students). Students self-selected available time slots on a first-come, first-served basis, without access to information about the identities of other students assigned to the same group.

First, we analyze students' responses to Q20: Which type of mentoring meeting do you prefer?. The results showed a mean value of 3.93 indicating a slight overall preference for one-on-one meetings (5 in the Likert scale) over group meetings (1 in the Likert scale). However, one needs to take into consideration that three quarters of the faculty did not hold group meetings, which influences this significantly.

Next, we examine the relationship between mentoring format students experienced (Q3), and students' preferences for mentoring format (Q20). Question Q3 asked students to report whether they participated in group mentoring (coded as 1) or one-on-one mentoring (coded as 2), while question Q20 asked students about their preference for mentoring formats, ranging from "I much prefer group meetings" (value of 1) to "I much prefer one-on-one meetings" (value of 5). The cross-tabulation results are shown in Table 2.

The results showed that students who experienced the one-on-one mentoring format generally preferred this approach. However, the preference was not universal, as approximately 22% did not identify one-on-one as their preferred format. In contrast, the preferences among students who experienced the group mentoring format were less pronounced with approximately 56% of indicating a preference for group meetings. These findings underscore the variability in individual student preferences and suggest that choices between individual and group sessions may be influenced by factors such as personal comfort and scheduling constraints. Therefore, while group mentoring sessions may help reduce student stress, as some students feel more comfortable interacting alongside peers rather than in individual meetings with a mentor, it is important to

	Preference	Q3 (Experienced Mentoring Format)		Total
		Group (1)	One-on-One (2)	
Q20 (Preference for Mentoring Format)	Much prefer group (1)	10 (16.9%)	1 (0.6%)	11 (5.1%)
	Somewhat prefer group (2)	16 (27.1%)	1 (0.6%)	17 (7.9%)
	Neutral (3)	16 (27.1%)	32 (20.6%)	48 (22.4%)
	Somewhat prefer one-on-one (4)	6 (10.2%)	31 (20.0%)	37 (17.3%)
	Much prefer one-on-one (5)	11 (18.6%)	90 (58.1%)	101 (47.2%)
Total		59	155	214

Table 2: Cross-tabulation of experienced (Q3) vs. preferred (Q20) mentoring meeting format.

provide students with the option of individual meetings to address private or sensitive concerns.

It is also important to note that random assignment to group or individual mentoring formats could reduce potential selection bias. However, such an approach was not practically feasible due to students' conflicting schedules. Consequently, scheduling constraints should be considered when interpreting these preference data. Notably, a substantial proportion of students in both formats reported having no clear preference, indicating that while the mentoring format is relevant, additional factors influence student perceptions. These factors may include the mentor's communication style, the quality of the mentor–student relationship, and the overall structure of the mentoring sessions. Collectively, these findings suggest that providing flexible mentoring format options may better accommodate the diverse needs of students.

Next, a Chi-square test was conducted to determine if the relationship between mentoring format and preferences was statistically significant ($\chi^2(4) = 293.38, p < 0.001$). The results indicate that students generally prefer the mentoring format they experienced. It is quite likely that this difference is due to the fact that three quarters of the faculty carry out their mentoring meetings as one-on-one.

Finally, we analyze the distribution of students' preferences for mentoring formats (Q20) across group sizes (Q4). The results are presented in Table 3 below.

	Preference	Q4 (Group size)					Total
		1	2	3	4	5	
Q20 (Preference for Mentoring Format)	Much prefer group (1)	7	1	1	2	0	11
	Somewhat prefer group (2)	6	1	2	5	3	17
	Neutral (3)	5	33	4	3	3	48
	Somewhat prefer one-on-one (4)	0	30	3	1	3	37
	Much prefer one-on-one (5)	0	91	6	1	3	101
Total		18	156	16	12	12	214

Table 3: Students' preferences for mentoring format (Q20) by group size (Q4).

It is quite surprising that students in one-on-one meetings showed a strong preference for group meeting, with no preference for one-on-one meetings. On the other hand, students in groups of two have a strong preference for one-on-one meetings, with only 1.3% preferring group meetings.

A one-way ANOVA was performed to examine whether there is a relationship between group size and the student preferences for mentoring formats. The analysis shows that there are statistically significant differences in preferences between group sizes, $F(4, 209) = 36.162, p = 0.001$, which supports our observations from the results in Table 3.

Preferred mentoring meeting format vs academic year.

The section aims to understand if students prefer different mentoring meeting format (Q20) based on the students' academic year (Q1). The students' preferences by the academic year are presented in Table 4 below. These results indicate that most students prefer the one-on-one meetings, irrespective of their academic year. However, we must recall that around 75% of the faculty do not have group meetings. The results of Chi-square test of independence do show a significant statistical association between academic year and mentoring meeting format preference, $\chi^2(16, N = 214) = 239.38, p < .001$.

	Freshman	Sophomore	Junior	Senior	Total
Much prefer group	3 (5.5%)	2 (4.4%)	3 (4.8%)	3 (5.8%)	11 (5.1%)
Somewhat prefer group	4 (7.3%)	3 (6.7%)	7 (11.3%)	3 (5.8%)	17 (7.9%)
Same/doesn't matter	13 (23.6%)	11 (24.4%)	15 (24.2%)	9 (17.3%)	48 (22.4%)
Somewhat prefer 1-on-1	9 (16.4%)	11 (24.4%)	11 (17.7%)	6 (11.5%)	37 (17.3%)
Much prefer 1-on-1	26 (47.3%)	18 (40.0%)	26 (41.9%)	31 (59.6%)	101 (47.2%)
Total	55 (100.0%)	45 (100.0%)	62 (100.0%)	52 (100.0%)	214 (100.0%)

Table 4: Academic year (Q1) vs. preferred mentoring meeting format preference (Q20).

Findings on preferred meeting frequency

Next, we examine the most common preferences for mentoring meeting frequency (Q19) among students and faculty (Q4) who could choose from the following options: once a month, once a semester, or once a year. The results are presented in Table 5.

	Once a month	Once a semester	Once a year	Other
Students	26 (12.15%)	132 (61.68%)	39 (18.22%)	17 (7.9%)
Faculty	1 (5%)	13 (65%)	0 (0%)	7 (30%)

Table 5: Preferred frequency for meetings (Q19 (student survey) and Q4 (faculty survey)).

The results suggest that both groups (students and faculty) prefer mentoring meetings to be held once a semester, with approximately 62% of both student and faculty respondents selecting this option. From the students' perspective, this was followed by the "once a year" option, chosen by around 18% of students. The least popular options were "once a month" and "other", for both students and faculty.

Question Q18 in the student survey is an open ended question asking if they think the mentoring meetings should be optional, and 56% of students do think they should be optional, including them being optional depending on their academic standing. Question Q3 in the faculty survey is a multiple choice question also asking if they think the mentoring meetings should be optional.

Table 6 summarizes the results, which show that only 18% of faculty do think they should be optional altogether, and 18% think they should be optional depending on their academic standing.

	# of responses	percent
Yes, mentoring should be optional	4	18.18%
No, mentoring should be required for all students	11	50.00%
Depends on the student's year or academic standing	4	18.18%
Not sure	1	4.50%
Other	2	9.00%

Table 6: Q3: Should mentoring meetings be optional?

Preferred meeting frequency vs academic year.

In order to examine whether students' preferred frequency of mentoring meetings (Q19) differs with the grade level (Q1), we conducted a Chi-square test of independence. The results show a statistically significant association between grade level and preferred meeting frequency, $\chi^2(16, N = 214) = 239.38, p < .001$. The students' preferences by the academic level are shown in Table 7.

Year	Once per month	Once per semester	Once per year	As needed	Total
Freshman	14 (25.5%)	29 (52.7%)	10 (18.2%)	2 (3.6%)	55 (100.0%)
Sophomore	2 (4.4%)	33 (73.3%)	7 (15.6%)	3 (6.7%)	45 (100.0%)
Junior	7 (11.3%)	42 (67.7%)	7 (11.3%)	6 (9.7%)	62 (100.0%)
Senior	3 (5.8%)	28 (53.8%)	15 (28.8%)	6 (11.5%)	52 (100.0%)
Total	26 (100.0%)	132 (100.0%)	39 (100.0%)	17 (100.0%)	17 (100.0%)

Table 7: Academic year (Q1) vs. preferred mentoring meeting frequency preference (Q19).

The results showed that "Once per semester" was the top choice for every grade level, which is the meeting frequency currently in place in the department. However, as a second choice, freshmen preferred the most frequent option, of "once per month", which could be attributed to their minimum to no experience as college students and the need of great amount of assistance navigating the transition from high school. On the other hand, seniors shifted toward less frequent meetings, which could be because as they get closer to graduation, they didn't need as much assistance as in their beginning years.

Findings on preferred meeting duration

Faculty responses indicate that typical one-on-one meeting length was 15-20 minutes, with 13% of the meetings having shorter duration and 13% having longer duration. Question Q17 (Has the allocated time been sufficient to address all your questions?) has a mean value of 2.86 indicating that students typically felt the allocated time for the mentoring meeting was not sufficient (1 being too short and 5 being too long).

We also conducted an ANOVA analysis to explore if the perception of time sufficiency (Q17) varies across mentoring formats (Q3). The results show no statistically significant difference, with $F(1, 212) = 0.126, p = 0.723$. Therefore, students find the allocated meeting time insufficient regardless of the meeting format.

These results indicate a disconnect between commonly implemented meeting durations and students' perceived needs. Hence, these findings suggest increasing the duration of mentoring meetings or providing follow-up mechanisms beyond the scheduled session. In this way, it can improve the effectiveness of mentoring meeting, especially giving the students' diverse backgrounds and needs.

Findings on faculty's perspective about mentoring goals

This section presents the faculty perspective on the primary purpose of the mentoring meetings (Q1). As the data in table 8 show, there is no common faculty perspective on the purpose of the mentoring meetings. Consequently, each faculty provides a different experience for their mentees. This is consistent with the literature, which clearly indicates that there is no agreed upon definition of what mentoring entails.

	# of responses	percent
Provide academic guidance and course planning	8	11.11%
Support students' career and graduate school goals	17	23.61%
Offer personal or professional advice	15	20.83%
Foster a sense of belonging and connection	13	18.06%
Discuss undergrad research or project opportunities	9	12.50%
Help students manage time, stress, or motivation	10	13.89%

Table 8: Primary purpose of the mentoring meetings.

Findings on faculty's mentoring resources

Here we analyze the faculty opinion on the helpful resources for preparing for mentoring meetings (Q11). Faculty were provided with a list of options with the opportunity to select all that apply. Figure 1 depicts the results.

The results show that two resources were considered particularly useful from the faculty perspective. Here, 60% of faculty members would like to have guidance by academic level, which is consistent with students' needs differ by academic level. Additionally, almost half of the faculty would like to have a list of suggested discussion topics. Therefore, the recommendation to the unit in charge is to compile and provide the resources in order to make the mentoring meetings more useful and efficient.

Findings on common meeting topics

Here we present the results on the most common topics students bring up during mentoring meetings (Q12). Again, faculty were provided with a list of options with the opportunity to select all that applies. Figure 2 depicts the results.

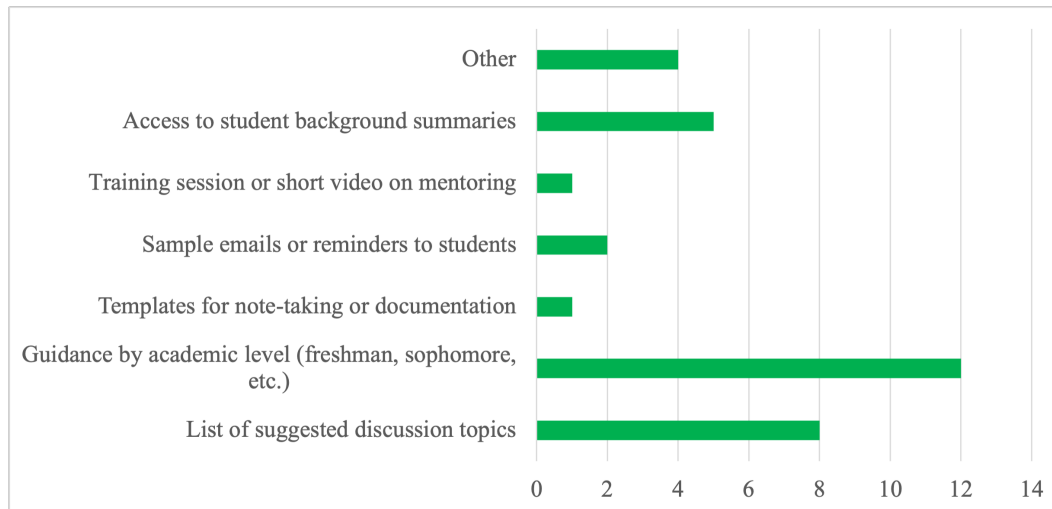


Figure 1: Useful resources for mentoring meeting preparation.



Figure 2: Common topics students bring up during mentoring.

The results indicate that the two most common topics are application to graduate school and research opportunities, followed by internship or career advice. Indeed, there is the relation between the most popular topics touching on future plans and the practical side of engineering.

Limitations

A primary limitation of this study is the potential for bias resulting from the inability to randomly assign students to group or one-on-one mentoring sessions due to scheduling constraints and faculty preferences. Additionally, the number of participants was relatively low with about 20% of faculty participants in the survey. While the number of students participated in the survey was substantial, it represents approximately half the participation rate of faculty when considered

proportionally.

Conclusions

This work provides insight into the experiences and preferences of undergraduate students and faculty participating in a mandatory mentoring program within the Electrical and Computer Engineering department at a large public university. The study identifies key factors that influence the effectiveness of mentoring relationships, including meeting format, frequency, duration, and discussion topics.

The findings indicate that the students' preferences for mentoring formats are strongly influenced by their previous experiences. While a majority of faculty do not currently conduct group mentoring sessions, they only conduct one-on-one meetings, previous research and the results of this study suggest that incorporating group meetings may be beneficial. Although the findings indicate a slight student preference for one-on-one mentoring, students generally prefer the format with which they have prior experience. Notably, first-year students tend to favor group meetings, whereas seniors prefer one-on-one sessions, potentially reflecting the value newer students place on learning from more experienced peers.

Additionally, the results showed alignment between students and faculty in preferring mentoring meetings to be mandatory and held once per semester. However, students frequently reported that the typical meeting duration of 15–20 minutes was insufficient. Additional meeting time or follow-up mechanisms may be necessary to adequately address students' questions and support their needs..

Finally, faculty preferences related to meeting logistics, as well as the resources and preparation needed to conduct effective mentoring sessions, were examined. These findings provide actionable insights that can improve the effectiveness of mentoring meetings for both students and faculty. More broadly, the results of this study may serve as a reference for other departments or institutions in refining their structured mentoring programs.

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Appendix 1: Survey questions.

Table 9: Student survey questions.

Question #	Question (options if not Likert)
Q1	What is your academic standing? (Freshman, Sophomore, Junior, Senior)
Q2	How many semesters have you already been an undergraduate student? (0-8, other)
Q3	What was the format of the mentoring meeting? (Group meeting, One-on-one meeting)
Q4	If you had a group meeting, how many other students were in the group? If you had one-on-one meeting, select 0. (1-4)
Q5	To what extent has the mentoring meeting met your expectations?
Q6	How supportive has your faculty mentor been about your professional goals?
Q7	How supportive has your faculty mentor been about your academic goals?
Q8	How supportive has your faculty mentor been about your life goals?
Q9	How easy has it been to discuss ideas about elective options with your faculty mentor?
Q10	How easy has it been to discuss ideas about career options with your faculty mentor?
Q11	How easy has it been to discuss ideas about internship options with your faculty mentor?
Q12	How easy has it been to discuss ideas about research options with your faculty mentor?
Q13	How helpful has your faculty mentor been in balancing your class schedule with other obligations?
Q14	How well has your faculty mentor helped you in developing better time management skills?
Q15	In general, how helpful have you found the mentoring meeting?
Q16	Please explain your answer to the question above (open-ended)
Q17	Has the allocated time been sufficient to address all your questions?
Q18	Do you think the mentoring meetings should be optional? Why or why not? (open-ended)
Q19	How often do you think mentoring meetings should be held? (once a month, once a semester, once a year, Other)
Q20	Which type of mentoring meeting do you prefer?
Q21	How stressful has it been to talk to your mentor?
Q22	How stressful has it been to come up with questions before the meeting?
Q23	What topics would you like to discuss during mentoring meetings? (open-ended)
Q24	What resources do you think your mentor should provide during mentoring meetings? (open-ended)
Q25	What else would you like to address during the mentoring meeting? (open-ended)
Q26	How can the mentoring meetings be more beneficial for you? (open-ended)

Table 10: Faculty survey questions - part 1.

Question #	Question (options if not Likert)
Q1	What do you believe is the primary purpose of mentoring undergraduate students in the ECE department? (select all that apply) - Provide academic guidance and course planning - Support students' career and graduate school goals - Offer personal or professional advice - Foster a sense of belonging and connection - Discuss undergrad research or project opportunities - Help students manage time, stress, or motivation - Other
Q2	In your opinion, how should undergraduate mentoring differ from academic advising? - Mentoring should focus more on long-term development and advising on course logistics - Mentoring should emphasize personal growth and relationship-building - Mentoring and advising should be combined - They are essentially the same - Other
Q3	Do you believe mentoring meetings should be optional for students? - Yes, mentoring should be optional - No, mentoring should be required for all students - Depends on the student's year or academic standing - Not sure

Question #	Question (options if not Likert)
	- Other
Q4	How frequently do you prefer to meet with your undergraduate mentees? - Once per month - Once per semester - Once per academic year - Only as needed - Other
Q5	What is the typical duration of your one-on-one mentoring meetings? - 5 minutes - 10 minutes - 15 minutes - 20 minutes - 30 minutes - Longer than 30 minutes
Q6	What is the typical duration of your group mentoring meetings? - 10 minutes - 15 minutes - 30 minutes - 45 minutes - Longer than 45 minutes - I do not hold group meetings
Q7	What do you typically do if a student misses their scheduled mentoring meeting? - Reschedule immediately - Wait for the student to contact me - Remind them by email - Skip until the next mentoring period - Other
Q8	How often do you remind students about their mentoring meetings? - Always (for every meeting) - Often (most meetings) - Sometimes - Rarely - Never - Department staff handle reminders
Q9	How could the pre-meeting questionnaire be improved to make better use of it? - Shorten it - Include more specific questions - Focus on current student needs (career, courses, well-being, etc.) - Make it easier to fill out (online form, reminders) - It's already effective as is - I don't use a pre-meeting questionnaire - Other
Q10	Would you find it helpful if the department provided standardized guidelines for mentoring meetings? - Yes, very helpful - Somewhat helpful - Not helpful - Not sure
Q11	What resources would be most useful to help you prepare for mentoring meetings? (Select all that apply) - List of suggested discussion topics - Guidance by academic level (freshman, sophomore, etc.) - Templates for note-taking or documentation - Sample emails or reminders to students

Question #	Question (options if not Likert)
	- Training session or short video on mentoring - Access to student background summaries - Other
Q12	What are the most common topics students bring up during mentoring? (Select all that apply) - Course registration or scheduling - Graduate school or research opportunities - Internship or career advice - Time management or workload - Personal challenges or motivation - Departmental involvement (clubs, competitions) - Other
Q13	What changes or support from the department would make mentoring more effective or enjoyable for you?