Electrical & Computer Engineering Students' Approach to Academic Advising and Course Selection

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1. Introduction

Faculty advisors at the University of University of New Haven often complain about what they see as a lack of student engagement in the process of planning their curriculum and registering for classes. Students enter advising meetings without looking at the course schedule beforehand or expecting their advisors to create a schedule for them. How do we encourage students to be more proactive in this process? What additional information or tools do they need to take ownership of their academic and professional futures?

We hypothesized that students need more information around the alignment of their courses with their career objectives to engage more fully in registration and curriculum planning a part of the main role of academic advising. In the Fall 2022 advising period, we administered a survey to Engineering and Computer Science students at a mid-sized comprehensive university to gain insight into their approach to and understanding of course selection and registration. Based on these findings, we plan to develop a tool that will clarify the connection between academic courses and the technical skills or competencies necessary for success in their selected careers. We hope the tool will empower students to take more ownership over their curriculum planning and encourage faculty advisors to engage with students in more productive conversations about their career aspirations and preparation.

In effect, the tool would help more faculty take a more developmental approach to advising. Since the 1980s, scholars have defined the developmental approach to advising as the gold standard with some defining effective application of this approach as "advising as teaching." [2, 3, 6] Student ownership over their curriculum and academic experience is a central outcome of developmental advising, which charges advisors to help students integrate career and academic goals and address their unique challenges and desires. [2, 3, 4, 5, 8, 9] Developmental advising has been shown to increase student satisfaction and retention, partly because of the personal connection with a mentor. [2, 9] In 2008, Janine M. Allen and Cathleen L. Smith argued that while faculty advisors recognized the importance of career guidance and other support to student success, they viewed their own advising responsibilities as limited to ensuring students fulfilled graduation requirements. [1] However, Elizabeth Hart-Baldridge's qualitative study with 11 faculty advisors suggests that while some faculty have embraced a more holistic approach to advising, they may feel underprepared and underinformed in guiding these discussions. [9] Registration software presented one challenge [9], but faculty awareness about available careers and how to prepare students for those fields is likely another. [5,7] We need a tool to help facilitate these conversations and encourage students to take more ownership over the advising and curriculum process. To aid in developing such a tool, we created a survey to gain insight into students' mindsets around the academic advising process. During the Fall 2022 advising period, students in the Electrical & Computer Engineering and Computer Science Department were surveyed about their approach, understanding, and goals of academic advising and course selection.

The 18 questions survey asked for students' feedback in the areas of:

1. The usefulness of the current tools of the worksheet and degree audit
2. Frustrations and satisfaction with current advising practices
3. Explaining their current process of course selection
4. Understand if and how students use course selection to meet the development of technical skills and future career paths
5. Understanding career goals

The survey results showed that almost all students currently use one or more of the curriculum-planning tools provided to them and have an idea of their career goals. Most students also choose courses based on these goals, but also reported unclear course descriptions and a need for clarity on the alignment between courses and skills.

Based on these findings, we plan to design a tool that maps career paths to technical skills and skills to courses to help students visualize how a specific course will build tools related to their desired career paths. Our hypothesis (for a future paper) is that this information and the opportunity to "try on" different skills will increase student ownership and facilitate career-oriented conversations between faculty advisors and students.

While many of the findings in the survey are relevant only to the University of New Haven students, results may offer more general insight into college students' approach to advising and registration. We also expect the tool under development to be a model for faculty advisors in other programs and at other universities and colleges.

2. Survey

We developed an extensive survey that asked for feedback on several topics that address advising and the registration process for the students. The survey was structured to gain insights into demographics, how students approach registration, the course selection process, course information, and career goals.

The University of New Haven has a combined department that includes Electrical & Computer Engineering, Computer Science, and Cybersecurity. Therefore, the advising process for the three programs follows the same structure with the same tools being used. In addition, there is one advisor for each program, so there is minimal variation in the advising for each program.

The survey was deployed for all programs in the department. Therefore, we expected to receive similar results from the entire department population. Across the three programs, students share several courses, cross-populate electives, and move some by changing majors.

The list of questions for the survey is listed in the survey results section of the paper. The basic section of type of questions for completeness are:

- *Demographics*
- *Registration Process*
- *Selecting Courses*

- *Course Information*
- *Career Goals*

3. Survey Results

Demographics

Question	ALL	ECE
Q1. What is your major?		
-Electrical & Computer Engineering	16	
-Computer Science	8	
-Cybersecurity	8	
Q2. What year of study are you in?		
-Freshman	1	1
-Sophomore	8	2
-Junior	10	2
-Senior	13	11

The survey demographics met our expectations, with an even divide between the ECE and computing majors. Overall, for all majors, Junior and Senior students made up 72% of the participants, which led to good results as those students have met at least five times with their advisors and have had to pick multiple electives.

Registration Process

Question	ALL	ECE
Q3. Which of the following best describes how well you understand how the required courses help you develop the fundamental skills for your professional life?		
-I can clearly see how all my courses are important for someone working in my field	10	6
-I believe only some of the required courses are needed in my field and other courses are only needed for specific areas that I may not be working in	21	9
-I believe the required courses offer important background information but the material is outdated in today's technology environment	1	1
Q4. Which of the flowing best describes how you feel about registration? Select all that apply		
-Excited: I like seeing what classes are offered and imagining the future.	7	1
-Fine: I know what I need to do and just sit down and do it.	17	10

-Overwhelmed: There are too many options and I don't know what I need to take.	5	2
-Anxious: I'm afraid I'll sign up for the wrong thing and delay graduation/ never graduate.	8	3
-Disappointed: The courses never align with what I want to take.	4	4
Q5. How often have you used Degree Audit when you prepare to register for classes?		
-Always	23	10
-Sometimes	6	5
-Never	1	1
Q6. How likely were you to use a major worksheet when you prepare to register for classes?		
-Always	9	7
-Sometimes	13	7
-Never	10	2
Q7. When you select classes last semester, how did you determine which classes you needed to complete your major? Select all that apply.		
-I looked at Degree Audit to see what I'm missing	24	10
-I looked at the Major Worksheet to see which courses I should take that semester	13	10
-I used my own spreadsheet or another document where I keep track of my progress and what I need to take each semester	7	4
-I asked my advisor	21	9

For Question 3, we were surprised that only one student believed that required courses needed to be updated. In our experience, students have mentioned in exit surveys that they felt the material to be less up-to-date. With most students believing only some required courses were needed for all specialties, future follow-up is necessary at the curriculum level to help students understand the connection between courses.

In Question 4, most students perceive advising/registration as a routine task. Only one ECE student expressed excitement, suggesting that gamification could make the process more engaging. More CS/Cybersecurity students reported excitement, attributing it to new AI and game development courses. To increase enthusiasm, the ECE program should consider incorporating AI into their offerings.

Questions 5-8 reveal students' use of registration tools, which will inform our new tool development. In Question 7, students often rely on advisors for course selection, highlighting their crucial role in guiding students through early career preparation. Even with their use of tools, advisors are the main conduit for students navigating their early career preparation.

Last semester, students commonly used multiple tools to monitor their academic progress: 24 used Degree Audit, 13 used the major worksheet, and 7 used only the worksheet. 28% always used the worksheet, while 40% used it occasionally. One sophomore never used Degree Audit. Open-ended responses highlighted the significance of Degree Audit and advisors, with over 10 students emphasizing their importance. Most students employed available tools, often using more than one.

Selecting Courses

	Average Rating on 1-5 Scale	
Question	ALL	ECE
Q9. The time/day the course was offered fit your schedule	3.84	3.88
Q10. You had friends who were taking the course	2.22	2.44
Q11. You liked the Instructor	3.69	3.75
Q12. The topic or skills in the course aligned with your Career Goals	3.66	3.56
Q13. You were interested in the course topic	3.69	3.56

Survey results indicate that 66% of students think only some required courses are relevant to their fields. Course alignment with career goals is important for 88% during selection, with 60% rating it a 5. The four students who rated alignment low also reported poor understanding of courses' relation to technical skills, but their interest in course topics matched their career aspirations. This suggests a need to clarify how courses contribute to students' career trajectories and professional development.

Course Information

	Average Rating on 1-5 Scale	
Question	ALL	ECE
Q14 How clearly did you understand how a course connects to the technical skills in the field?	3.38	3.38
Q15. How helpful did you find the course description in picking your courses?	3.13	3.13
Q16. How strongly did you consider the technical skills taught in the course when picking your elective courses? (1=not at all to 5 = very strongly)	3.41	3.69
	Number of Responses	
Q17. What other considerations, if any, were important? (Open Ended)		
What allows me to graduate on time	2	
decide if that class instructor will be good based off of my and friends experiences	2	

Q18. What additional information do you fell you need to find the best courses for you? (Open Ended)		
See some of the course material	1	
Most of course my advisor assign to me. I would like to better understand my options	1	
See syllabus before signing up for classes	1	
Information about the professor	2	
Q19. What caused the most frustration for you while choosing your major electives? (open ended)		
More classes that fit my interest	1	
Lack of course description	2	
Number of credits each semester	1	
One section of courses	1	
Courses only being offered in one semester	3	

Only 44% of students have a good understanding of how courses connect to technical skills in their field. However, of those who answered "clear" or "perfectly clear", 79% reported "strongly" or "very strongly" considering the technical skills taught when selecting major elective courses. This suggests that those who have a good understanding of the field do indeed consider technical skills in course selection.

Career Goals

Question	ALL	ECE
Q20. How clearly have you defined your specific career goals?		
-I have no idea	3	1
-I have a clear idea of what kind of work I want to do but don't know the name of the position or role. (Example, I want to do programming but I'm not sure about the field such as web, mobile, desktop, etc. I want to design antennas but I'm not sure if they would be for satellites, Wi-Fi, etc.)	15	10
-I know the specific industry I want to work in but not necessarily a specific role. (Example: aerospace, defense, video games, etc.)	11	3
-I know the specific industry I want to work in and the role I want to fill. (Example: I want to design a Mar's rover at NASA).	3	2

Question 20 highlights the advising process's significance, with 8% of students having clear career goals. ECE students typically have a better understanding of their desired roles, while CS/Cybersecurity students are more aware of their preferred industry.

Most ECE senior students have developed preferences based on their best-performing areas, like communication or power systems, helping them identify suitable roles. In contrast, CS students prioritize working for specific companies like Google, Mitre, and Microsoft.

The program requires an internship before graduation, typically during the summer of junior year. We expected more ECE seniors, who have completed internships, to have a better understanding of their desired industry and role as they approach the workforce.

Other Findings

Updating course descriptions to highlight relevant technical skills and industries could enhance student engagement in curriculum planning. Although older descriptions are often vague, allowing flexibility for professional requirements, the advising tool should be regularly updated to reflect evolving skills, requirements, and career paths.

- **Caveat**: The primary frustration in open-ended responses involved course timing and scheduling, particularly for commuter students. This implies that students may skip courses aligned with career objectives if they inconveniently require special trips to campus or have suboptimal timing.

4. Next Steps

The survey provided us with the following main takeaways: We could infer that students value the connection between their courses and career goals, but there is room for improvement in understanding how courses develop the necessary technical skills. To better support students, advisors could emphasize course relevance to professional life and offer additional guidance during the registration process.

Advising Improvements

For the academic advisors our survey results have suggested that the major area for improvement is the career guidance. Since the students stated that they find the course description to be lacking the advisor could: 1. Look to improve the formal course description, 2. Discuss with the student how courses fit with a given career, and 3. Have more extended informal course descriptions/syllabus for students to examine.

New Tool

A new tool could be developed to help students connect courses with career goals, promoting ownership of course selection. This tool would foster discussions on career goals between students and advisors, providing a clear vision and starting point. Students would be better prepared for advising meetings, confidently addressing personal questions in developmental advising. High usage of curriculum-planning tools and interest in aligning curriculum with career paths suggest students would adopt such a tool.

The goals we will use in designing the new tool include the following:

- The tool should clarify how courses develop technical skills in students' fields, as many reported only partial understanding, with just 44% indicating clear or perfect clarity.
- It should provide role-specific maps and highlight differences across industries, enabling students to compare skillsets between roles in different sectors, e.g., antenna designers in aerospace and mobile technology.
- As most students have an idea of their desired role or industry, the tool could cater to a wide range of students, with only 3/32 unsure about their career path or industry.
- The tool could address low confidence in or attention to course descriptions (20/32 students don't read or find them helpful) by illustrating how class concepts align with careers/industries, thus improving comprehension.

5. Conclusion

Faculty advisors at the University of New Haven, and likely at other institutions, can take comfort in knowing that students utilize tools for curriculum planning and seek alignment with career goals. However, their limited clarity on specific skills developed in each course and the technical skills required for their desired field or position hinders full ownership of course selection, making them rely on advisors for guidance.

By having advising meeting to focus more or career guidance can help the students understand their curriculum better. A new tool mapping skills to careers and specific courses can address this knowledge gap, empowering engineering students across all programs (ECE, CS/Cybersecurity) to actively engage in faculty advising meetings.

6. References

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