Undergraduate Engineering Students' Experiences of Faculty Recognition

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1 Introduction and Background

This full research paper explores how undergraduate engineering students experience the recognition of their engineering identities by faculty. How students see themselves as engineers has implications for how they are motivated, persist through their programs, and learn engineering material [1]- [3] which has led to calls for supporting students' engineering identities alongside traditionally taught competences [4]-[8]. The degree to which students feel recognized or seen as the "kind of person" who can do engineering has been delineated as the most important element in the development of an engineering identity [9], [10]. An understanding of recognition is critical for designing high-impact curricular practices that support identity development and in guiding program culture that includes students in the community of engineering. Researchers have explored if students believe others see them as engineers and emphasized the importance of these beliefs [11], [12], but less is known regarding how engineering students develop these recognition beliefs.

Existing identity work has illustrated that students perceive recognition differently depending on who the recognition is coming from [10], [13], [14]. The difference between sources of recognition is most often explored in terms of the prevalence of recognition from different groups including peers, family, and faculty. Engineering faculty have been identified as high impact sources of recognition, but this has been mostly explored with respect to the frequency of interaction with engineering students in an educational context [13], [15], [16]. While recognition from engineering faculty has been considered supportive of students' overall recognition beliefs [13], [15], how students experience this recognition is presently unexplored. Recognition from engineering faculty is important to understand as their positions relative to students situate them as an easily accessed supportive element in students' identity development and as embedded members of the community tasked with guiding students into engineering. This work seeks to explore students' perceptions of recognition from engineering faculty by leveraging the research question (RQ):

> **RQ:** How do undergraduate engineering students experience the recognition of their engineering identities by engineering faculty?

Semi-structured focus groups and thematic analysis were used to identify three main themes: how participants valued recognition from faculty, felt seen as engineers-in-progress, and perceived recognition as respect. These themes emerged differently when recognition came from instructional faculty compared to mentorship faculty which illustrated nuances in how students felt they were respectfully recognized as engineers-in-progress.

2 Theoretical Framework

To answer research questions seeking to understand how students feel seen as engineers by engineering faculty, this work leverages recognition as situated within engineering role identity. Engineering role identity considers how students take on the role of an engineer by engaging with specific practices, developing social networks, and taking on the duties, responsibilities, and knowledge associated with the profession [11], [17], [18]. Students come to see themselves as engineers through a dialogical process of positioning themselves and being positioned by others as engineers or people who can do engineering [19], [20]. Who is recognized for what is

racialized and gendered as recognition is underwritten by systems of power and privilege that that constrain who one is allowed to be per the norms, rules, and routines of that world [10], [15], [19], [21], [22], [23]. This work takes a broad look at recognition experiences in the context of undergraduate engineering to start establishing a foundation that future work that specifically considers students social identities can build upon.

Broadly, Recognition conceptualizes students' perceptions of how others see them as engineers [11], [15] and is the most influential element in the development of engineering identities [9], [10]. This work focuses on the conceptualization of identity-supporting recognition as *meaningful recognition*. *Meaningful recognition* describes recognition that maintains or develops an engineering identity and is present "when an individual perceives and internalized this recognition" and it "counts for identity development [24, p. 99]." This recognition comes from *meaningful others* who are people whose recognition, opinions, and acceptance as engineers are valued by students [6], [10], [14]. This work focuses on the conceptualization of meaningfulness as not all recognition is considered *meaningful recognition* and not all people are considered *meaningful others* [14], [25]. This emphasis scopes this study so that it can better explore recognition experiences that may be perceived, interpreted, and internalized toward recognition beliefs. *Recognition beliefs* describe how students feel sources of recognition see them as engineers [11]. The presence of these beliefs is what is most often considered in engineering identity work, but little is known about how students develop these beliefs in an engineering context.

3 Methods

This paper reports longitudinal, qualitative results from an ongoing NSF-funded mixed-methods study (NSF grant #EHR-1833738) focusing on a cohort supporting engineering students who are both socioeconomically disadvantaged and academically talented [23]- [26]. This phenomenology-informed exploratory study utilized semi-structured focus groups to understand participants' experiences of having their engineering identities recognized by engineering faculty. This study includes data from participants' first six semesters in an engineering program to capture a variety of faculty-oriented engineering experiences that include the less frequently studied middle years [30]. Data was analyzed using directed content and thematic analysis to support the exploration of the phenomenon while allowing for the integration of a theoretical framework including identity and recognition. The first, second, and last authors played a significant role in the data collection and analysis portion of this study while the other authors were part of the PI team, contributed to the writing of this paper, and helped with the larger project's implementation.

3.1 Location and Participants

This study was conducted at a large, western land-grant, R1 university and focused on the lived- experiences of 38 undergraduate engineering students participating in a four-year cohort. Participants voluntarily applied to the four-year scholarship-based cohort program before starting their first semester and were selected based on financial need, academic ability, and letters of recommendation. Inclusion criteria for ongoing participation in this cohort include enrollment in an engineering major, a minimum GPA, attendance to cohort activities, and involvement in data collection. The participants enrolled in the cohort met with an assigned engineering faculty mentor individually twice a semester and interacted with all faculty mentors for the program at seminars held twice a semester.

Two cohorts operated concurrently with one starting in Fall of 2019 and a second starting in Fall of 2020. At the time of this study, the first cohort had completed eight semesters of their engineering program and cohort two had completed six semesters. For comparison across the two cohorts, only data from the first six semesters of each cohort was used for this study. As this cohort is an outward-facing program, major enrollment and demographic information including gender and race/ethnicity are removed to protect the identities of our participants. This population included mostly white men and women but had an above-average representation of first-generation students and underserved groups compared to the larger engineering college population. The participants did describe nuanced experiences of recognition per their social identities, but these were not units of analysis for this work as phenomenology sought to understand their shared experiences of recognition. At this institution, participants typically were enrolled in a large first-semester introductory engineering class before moving to smaller, discipline-specific classes during their second and third semesters. This sample's composition supports the transferability of findings to similar populations enrolled in undergraduate engineering programs but cannot speak to the experiences of populations not included or identified.

3.2 Data Collection

To explore participants' experiences of recognition from faculty, this study drew on phenomenology's operationalization of experiences to include the perceptions of an event happening and the related meaning making as participants interpret and internalize the recognition of their engineering identities [28]- [30]. A longitudinal approach was taken to appropriately capture the breadth of the experiences across an engineering program which is insufficiently captured in a single data point. Multiple semesterly focus groups were utilized to facilitate the sharing of group experiences, essential to the larger study about the benefits of the cohort, while still allowing for the sharing of individualized recognition experiences enhanced by participants' ability to compare with each other [34], [35]. In alignment with phenomenology and to best support the exploration of the personal, contextual, and perception-based phenomena of recognition, a semi-structured approach was used when collecting data [36]. Focus groups consisted of four to five participants, lasted about one hour, and were conducted at the end of each semester. The first author led all focus groups, with the second or last author as a secondary interviewer and notetaker. At the end of each focus group, the first author compiled these notes, information on how the focus group went, and initial impressions of the data into summarized memos.

A guiding research question prompted participants to reflect on how they felt others saw them as engineers. This question was derived from previous work that quantitatively explored undergraduate engineering identity and recognition beliefs [11] and specifically uses the phrasing "see you as an engineer" to keep questions in the participants' language [37]. The open-ended nature of the focus groups allowed for follow-up questions and permitted researchers to gather rich details about participants' experiences to go beyond whether they do or do not believe others saw them as an engineer and to better explore the qualities of experiences that led to these beliefs. Questions relevant to this study are presented in Table 1.

Table 1: Focus group guiding questions and common follow up questions (indicated by an indentation) presented with the targeted construct.

Focus Group Question	Target Information
Do others see you as an engineer? Who?	Recognition beliefs
How do you know they see you as an engineer?	Recognition perception
Has this changed at all since last semester? How? Why?	Change – past oriented
What needs to happen for people to start seeing you as an engineer?	Change – future oriented
Does this feel different depending on who sees you as an engineer?	Recognition interpretation

For the first cohort, initial data collection started at the end of the participants' first semester in the Fall of 2019 and continued for the participants' first six semesters in their undergraduate engineering program. Focus groups during the first semester were held in person but the following five were held via an online video platform due to the switch to remote learning as a result of the COVID-19 pandemic. For the second cohort, initial data collection started at the end of the participants' first semesters in the Fall of 2020 and continued for the participants' first six semesters in their undergraduate engineering program. Focus groups were solely held via an online video platform due to the switch to remote learning because of the COVID-19 pandemic. All focus groups were audio and video recorded, professionally transcribed by Rev.com, and checked for errors before being uploaded to the coding software NViVO12 (QST International).

3.3 Data Analysis

Directed qualitative content analysis and thematic analysis facilitated the examination of participants' recognition experiences across the first six semesters of their undergraduate program. Qualitative content analysis is an approach used to understand the study of a phenomenon [38] as it lends itself well to the description and interpretation of textual data about participants' lived experiences through codes and patterns [39], [40]. Directed or deductive qualitative content analysis does this while extending existing theory to different contexts or situations. In this study, recognition as a construct of role identity guided our understanding of participants' experiences. Directed content analysis was embedded in the overarching processes of thematic analysis in which data moves from transcripts to shared features and characteristics of the participants' experiences.

Researchers first familiarized themselves with the transcripts by listening to the audio files and rereading the transcripts [41]. Then transcripts were coded using an inductive pass derived from existing theory to index the data and provide a theoretical overview. This is recommended for longitudinal studies or ones with large quantities of data such as this [40], [42]. The guiding code "recognition" was pulled from existing role identity literature and leveraged Gee's interpretation of recognition to include the ways of being seen as an engineering person through discourse with "rational individuals [20, p. 103]." Pulling on theory that considers who recognition is coming from, additional codes focused on the sources or the recognition and categorized the recognition experiences in relation to the context it occurred and from whom it was perceived [11], [12]. Transcripts were first-pass team coded by the first, second, and last authors and emergent ideas around recognition were cataloged for future analysis. The primary, top-level deductive codes are described in Table 2.

Transcript data initially coded as "recognition" then underwent a deductive coding pass using an extended codebook derived from emergent recognition concepts identified through first-pass coding [40], [42]. Second-pass coding was conducted by the first author before being shared and discussed with the second and last authors, relevant top-level second-pass codes are provided in Table 2. These new codes were used to identify patterns and themes in what participants perceived as recognition and how they interpreted recognition as meaningful or valuable [40], [41]. Three major themes were identified in participants experiences that varied depending on whether faculty were instructional faculty in participants' classes or if the faculty were mentors to the students in their engineering cohort. In line with the phenomenological traditions guiding this work, descriptive features of what recognition was and how recognition was experienced are embedded in the themes and their synthesis in the following section [32].

Table 2: Definition and examples of top-level codes relevant to this study from the first and second coding passes. When appropriate, relevant subcodes are listed but not defined.

Pass	Code	Definition	Example
1st	Recognition Source	Participant delineates who is seeing them as an engineer. Includes relevant subcodes for teaching faculty and mentorship faculty.	*"Peers and faculty would probably view me as an aspiring engineer."*
	Context	Participant explains the setting that recognition took place or was facilitated. Relevant subcodes for classes, cohort, and research.	*"Two of my professors specifically this semester for 302 and 219 have especially made me feel like they believe in us as engineers"*
2nd	Meaningful	Participant illustrates why or why not recognition from faculty was valuable or meaningful.	*"They have done it and made it"*
	Recognized by…	Participant describes how they knew or felt that they were being recognized. Relevant subcodes for trust, respect, believed in, confidence, helping on path, etc.	*"I think like they see us as engineers because they're trying to help us be engineers."*
	Recognized for…	Participants describes what they were being recognized for. Relevant subcodes for expectations, progress, grades, etc.	*"Professors probably see us more as engineers than anybody else because they kind of expect us to know the content and also know the engineering process."*
	Seen as	Participants explains how they believed they were seen. Relevant subcodes include as engineers, students, or something else.	*"Professors see their students as engineering students."*
	Certainty	Participant describes how sure they were seen a certain way.	*"As far as professors or anything like that…I'm not sure what other people think."*
	Change	Participant describes feeling that how people have seen them as engineers has changed in any way.	*"I'm starting to feel like people, especially some of my professors, are starting to see me as an engineer."*

4 Results

Guided by the research question seeking to understand how students experience recognition from engineering faculty, our analysis identified three main themes. These themes capture how the participants described faculty as valuable sources of recognition, felt seen as engineers-in-progress, and perceived faculty recognition as respect. Each theme is described individually before being brought together in a synthesis that considers how the participants felt respected as engineers-in-progress in different contexts. The participants valued how faculty saw and treated them but experienced this recognition differently when it came from either instructional or mentorship faculty.

4.1 Faculty as valuable sources of recognition

Participants delineated how the recognition from faculty was valuable due to faculty members' status as engineers, their education experiences, and their knowledge of engineering content. The participants characterized engineering faculty as qualified to see them as engineers

compared to people outside of engineering whose views of them were *"not as meaningful as other engineering students, professors, or engineers working in the field (Gabe)."* The participants depicted faculty as having the title of engineer, which they connected to how they felt by association. Michael ties his views of faculty with his views of self when he explains, *"I feel like I'm dealing with engineers...you're interacting with other engineers. I'd say it helps you feel more professional."* In addition to faculty having the title of engineer, the participants outlined faculty recognition as valuable due to having similar education experiences. Noting that *"[faculty] have done it and made it (Holly)"* and have *"experienced and gone through engineering (Toby)"* were details that influenced the participants' perceived value of faculty recognition. The significance of those experiences is captured by Andy when he said, *"recognition from someone that's already experienced [earning an engineering degree] would be different compared to someone that knows nothing about what [engineering] consists of."*

The participants most frequently invoked faculty members' educational experiences and knowledge of engineering when explaining why recognition from faculty was particularly valuable. Faculty were uniquely situated to see the participants as engineers as they believed that one needed to know enough about engineering to meaningfully see someone as an engineer. Dwight outlines this connection when he describes recognition from faculty as *"[having] more credibility behind it because they have experienced that coursework and they've applied what they've learned."* The participants also believed that faculty had a nuanced understanding of where in the development process participants were in becoming full engineers that they could access through interactions *"usually about classes and helping us work to become engineers (Chris)."* The participants perceived recognition from faculty as credible due to their knowledge of what is needed to become an engineer and having appropriate interactions to accurately gauge where participants were on this developmental path.

4.2 Seen as engineers-in-progress

Although the participants describe feeling seen as engineers, they most often felt faculty see them as engineers-in-progress. The participants typically described being seen as *"future engineers (Pam)," "potential engineers (Mark)," "engineering in training (Jerry)," "aspiring engineers (Kelly),"* or some other version of not-yet-an-engineer but on the way. When the participants felt faculty saw them as engineers rather than as engineers-in-progress, they were less likely to agree with this recognition or doubted it and believed faculty were *"pretending to see me as a for real engineer (Holly)."*

During the first three years of their engineering program, participants were most likely to self-identify as engineering students rather than as engineers. When faculty recognition of them aligned with their views, the participants were more inclined to agree or accept this recognition of them as accurate. Toby explains that he agreed with faculty members' view of him as *"not yet there and that's fine. That's fine with me too."* Being viewed as an engineer in-progress, or *"not yet (Andy),"* was connected to the participants' perceptions of time in their program where they felt that *"it's just too early (David)"* to be or be seen as anything other in a developmental state. However, these participants conjectured that given more time they may start agreeing more with faculty recognizing them as engineers. Leslie describes this shared sentiment when they explained that some faculty *"really reinforce the idea that even though we are in school, we should see ourselves as engineers. I think that with enough time, all of us might start believing it more."*

The participants described specific experiences where they were explicitly called or referred to as engineers, but they more often expressed a general feeling of being seen that way. When asked if faculty see him as an engineer, Jim said, *"they haven't said anything specifically, but I feel like they see us as 'They're going to be good.' I don't know. That kind of thing."* Participants described feeling implicitly seen as engineers-in-progress when they felt faculty were helping them on the path towards becoming full engineers. Chris explains his perceptions of faculty recognition of him as a future engineer when he said, *"they're the ones who are teaching us and trying to make us become [engineers]."* The participants interwove elements of the previous theme regarding recognition from faculty being particularly valuable and credible with this messaging that they were in-progress. There was a shared belief that faculty know enough about engineering to determine where participants are on the path towards becoming one, but they are also helping them along said path as *"they're trying to get you to the place where you're an actual engineer (Diane)."*

4.3 Recognition as respect

Another way that the participants discussed feeling seen as an engineer by faculty was whether they were treated with respect. Darryl mentioned that *"some professors are a lot better at [being respectful] than others"* when recounting a range of experiences of respect and disrespect from faculty. How the participants in this study felt if they were or were not *"treated as a person (Pam)"* by faculty encapsulated their experiences of respect. Being treated as a person includes being talked to respectfully or feeling *"that the teacher actually knows who you are (Erin)."* Darryl in particular talks about the impact of respect when he said, *"it makes you feel like an engineer because you get treated as one. You get a lot more respect."* When the participants described feeling disrespected, they felt like they were not treated as equals or as mutual collaborators in education. Kevin explains this difference when he said, *"our professors are more like talking to us rather than we're talking with them."* There was a shared feeling that some professors *"just kind of like to put you down a peg (Holly),"* and the participants illustrated a variety of instances in which faculty talked down to them, minimized them as people, and delegitimized their efforts through shame. This theme of respect was prevalent in characterizing different contexts for recognition and will be further unpacked in the next section.

4.4 How being an engineer-in-progress is respected in different contexts

How the participants experienced being seen as engineers-in-progress concerning respect varied if the faculty were their engineering course instructors or if they were mentor figures in the cohort program. The participants believed recognition from instructional faculty was oriented around knowledge of engineering and that there was *"a lot of focus on being a master of your craft (Darryl)."* While participants felt recognized by instructional faculty as engineers in progress, their respect for students fluctuated depending on how the faculty member interpreted student progress toward acquiring this knowledge. A shared sentiment was that faculty saw them as potential engineers *"until you make a mistake. It doesn't matter if it's a small mistake or a huge mistake (Holly)."* Often disrespect occurred when the participants asked questions where faculty felt they should know the answer to already or when they did not perform as well as expected on assessments. Holly describes a particularly memorable experience after struggling on a midterm. She said:

> *"It's kind of hard to lift yourself up when you are getting pushed back down...in class he'll be like 'if you were smart you would get it done,' or 'A middle schooler should be able to do this. Why are you asking questions about it?'.... but the same professor that said*

things like that will turn around a treat you with a bunch of respect as long as you answer every answer correctly...so it's hard to navigate."

The participants explained that the inconsistent messaging made it hard for them to know how faculty saw them since *"sometimes they think we're great, that we're awesome students. Then sometimes they think that we're the dumbest people on the planet (Toby)."* These experiences of respect or disrespect hinging on whether students made mistakes or encountered failure made the participants feel fearful of asking questions during office hours or in class. Earlier on in their programs, the participants felt that *"professors are much more understanding that you're not a professional yet. But there is...a sort of attitude when people ask questions which is different than before (Holly)."* Although a few of the participants acknowledged that some faculty viewed them as in-progress *"but not in a condescending way (Toby),"* there was an excess of experiences of instructor recognition in which the participants felt being seen as in-progress meant not being treated with respect. The participants described that expectations started to dramatically increase during their third year as they believed faculty wanted them to be *"at the level of an engineer but there's not really the respect of being at an engineer level (Darryl)."* These experiences of disrespect from instructional faculty started to occur more frequently during the participants' second year and seemed to have lasting impacts on participants attending office hours and asking questions both inside and outside of class.

How the participants felt seen and treated as in-progress differed significantly when they described their experiences with faculty who acted as mentors in an engineering cohort program. Recognition from mentorship faculty was often mentioned in contrast to how the participants felt seen and respected by instructional faculty. Participants emphasized that their mentorship faculty treated them as people with names, ambitions, and worth despite being students. Darryl compared the recognition from instructional faculty as being seen as *"just a student, you're not, not really important. [Mentor faculty] treat us like we're important."* While participants felt that mentor faculty also recognized them as engineers-in-progress, they treated their learning processes with more respect than the instructional faculty. This perceived recognition aligned with how the participants viewed themselves while affirming their progress and future success. Leslie explains this positive effect when she mentions that *"[mentoring faculty] really were able to see that while we were incoming students into the program, we had a sense of who we are, what we wanted to do, and the accomplishments that we want to see in ourselves."* The participants frequently described feeling that mentoring faculty saw them as engineers-in-progress by impressing that *"they believe in us as engineers (Kevin)."* Feeling like mentoring faculty *"looked at me like I can be an engineer (Pam),"* or that they *"were confident in our ability to become engineers (Stanley),"* was a different perspective on being seen as in-progress that focused on what they could be in the future rather than focusing on what they presently do or do not know. The focus on future direction rather than present knowledge may be influenced by the mentorship faculty's limited interactions with participants in a teaching and learning context. The participants described how even though they felt seen as in-progress by mentoring faculty, they *"talk to you respectfully and not like you're just a student, that you're not, not really important (Darryl)."* Interactions with mentorship faculty were overall positive where the participants felt they were treated with the respect of full engineers and that being a student was not synonymous with less than.

5 Discussion

This study identified three major themes in undergraduate students' experiences of recognition from engineering faculty. We explored how these themes manifested in student interactions with instructional and mentorship engineering faculty. This comparison provides a richer understanding of recognition by elucidating student connections between feeling respected and recognized as engineers-in-progress by engineering faculty. Our participants conveyed more consistent respect and affirmation of their engineer-in-progress identities from mentorship faculty than instructional faculty members. These themes and their synthesis supported existing identity theory that classifies faculty as meaningful others and extends what qualifies them as meaningful others, how students access them, and their positioning as potential high impact sources of recognition. This work also adds nuance to the previously established relationship between recognition and engineering identity by illustrating how participants accepted or rejected recognition that did not align with how they viewed themselves. Finally, this work emphasizes the importance of the respectful treatment of engineering students by faculty as it may implicitly influence how students feel they belong in the engineering community.

5.1 Faculty as meaningful others

In engineering identity work, faculty have long been illustrated as meaningful others whose recognition may be supportive of students' identity development. This work corroborates existing literature that highlights engineering faculty as meaningful others and extends this understanding to include a more nuanced perspective as to why students value their recognition [10], [13], [15], [16]. Previous work explored how students qualify recognition sources as meaningful others based on their understanding of the engineering discipline [14]. In this work, the participants reiterate the importance of faculty members' engineering experience and knowledge and add to our understanding of why it is important for meaningful recognition. Our participants described how faculty members' titles as engineers, similar educational experiences, and expertise in their respective fields made them uniquely qualified to assess students' progress in their development as engineers. This aligns with previous work that delineates faculty as meaningful others to due being established members of the respective disciplinary community [10], [43].

In existing research, faculty are often presented as part of a lineup of meaningful others that includes family, peers, and professional engineers who are typically discussed in terms of their prevalence of recognition rather than comparative meaningfulness [13], [44], [45]. In this work, the participants state that recognition from faculty is established as more meaningful due to their titles, shared educational experience, and knowledge of engineering. The participants also described frequent interaction with faculty through classes, office hours, and mentoring relationships which may place faculty in many situations where they can meaningfully recognize students. It is important to acknowledge faculty's role in engineering identity development as they may stand as significant facilitators or gatekeepers of meaningful recognition.

5.2 Recognition alignment with identity

These findings extend existing work on recognition of engineering students by starting to illustrate what recognition can look like and connecting it to how it may be interpreted as meaningful. Engineering education researchers have been encouraging faculty to explicitly recognize engineering students by referring to them as engineers [1], [46], but this work highlights that participants often rejected this messaging when it did not align with their views of

self. The participants described seeing themselves as engineering students (i.e., engineers-in-progress), so when faculty called them engineers or tried to convince them they should see themselves as such, they felt this recognition was not valid. In engineering identity research, recognition is typically framed as a precursor to developing an engineering identity [1], [47] but here a circular pattern emerged in which participants' present identities influence how they experience recognition. The participants were much more accepting of explicit recognition as engineers-in-progress as they felt this was an accurate assessment of where they were per their perceptions of their engineering identity development.

The participants were more likely to agree with faculty recognition as engineers or engineers-in-progress when this recognition was connected with meaningful practices which is congruent by K-12 literature [6]. In this work the faculty implicitly recognized the participants by holding them to high expectations or treating them as engineers through respect. Although there was some uncertainty in how the participants felt faculty saw them, these experiences were more easily received since they were connected to practices or ways of being that the participants could connect with. Recognition that is unattached to reasons why they are seen as engineers may be valued less or disbelieved as it lacks proof. This is not to say that explicit recognition of faculty is not valuable and should not be done, just that for faculty to meaningfully recognize students as engineers it may require an additional approach that makes it clear why or for what practices they are being recognized.

5.3 To be an engineer is to be treated with respect

Respect is a well-established element of belongingness for students in engineering communities [48] and has been previously used to explore recognition from engineering peers [15], [41], [46]- [48]. The findings in this study corroborates existing research that illustrates the importance of respectful treatment of students, extends our understanding of recognition from faculty as respect, and further connects recognition and belonging through students' feelings of being respected. While the participants were often uncertain of how they were seen by faculty, they noticed indicators of faculty perceptions through implicit recognition that included if they felt they were treated with respect or disrespect. The participants wanted to be treated like people with value independent of whether they are meeting specific learning expectations and not demoralized or delegitimized when they encounter challenges on their path towards developing into full engineers.

Belonging literature has emphasized the importance of establishing an atmosphere of mutual respect where students are valued and treated as integral parts of the classroom cultures [52], [53]. In creating these environments, faculty may be doing more than just supporting how students believe they belong in engineering spaces but also in how they are seen and see themselves as engineers. The participants illustrated how recognition from faculty through respect and disrespect was impactful in how they felt seen as engineers and navigating future student-faculty relationships. If engineering education is going to answer calls to support engineering identity development curricular and programmatically, changes will need to consider features that support students beyond specific classroom assignments or projects. Engineering faculty serve as people already embedded in engineering communities who may help guide students into this community by making them feel like they do or do not belong in this field. How they interact and treat students in bringing them into engineering may be equally important

to understand and support as identifying specific curricular practices they can implement in their courses.

6 Implications

The presented themes and their synthesis shed light on students' perceptions of meaningful recognition from faculty. This work provides insight for engineering educators in both instructional and mentorship roles, program administrators, and centers for teaching and learning. Faculty could explicitly recognize students by referring to them both as engineers and engineers-in-progress along with specific reasons why. While early program students are receptive to being called engineers, after their first few semesters the students became more particular of what recognition counted and were skeptical of being called an engineer for no reason. By connecting how students are seen with why they are seen that way may be more valuable to students as this recognition may feel less like "empty words" and be connected to things students are starting to see in themselves. Faculty could implicitly recognize students by framing expectations as realistic engineering practices and conveying that students can do the things engineers are expected to do. Faculty could also implicitly recognize students through respectful treatment that centers on their value as people rather than based on their knowledge and performance. Respect should apply to faculty-student interaction as much as it does in faculty-faculty ones.

Program administrators could work to develop more opportunities for positive faculty and student interaction through mentorship programs. Programs could also consider how the treatment of students with respect can be incorporated as an element of the departmental culture through the onboarding process for new faculty and meaningful bias training. Mandatory workplace training could be expanded to include faculty-student interaction in class and office hours as extensions of the workplace. Additionally, programs could consider student feedback and complaints regarding instances of disrespect and develop procedures that help address and train problematic faculty so that they can become better support structures for their students going forward. Centers for teaching and learning on university campuses could include interpersonal practices as they prepare faculty to support identity in their curriculum and classes. While identity may be supported through specific features like testing, assignments, projects, and classroom setup, there may be other things to consider in training faculty to develop engineering identities through recognition. By mobilizing faculty in seeing students as engineers and engineering people through recognition as respect, students may be better supported in joining the community of engineering and seeing themselves as engineers.

7 Limitations and Future Work

Although this work exploring participants experiences of faculty recognition has valuable findings. for both research and education, there are limitations that must be made explicit to clarify its transferability. Firstly, all of the participants in this study were enrolled in a mentorship-based cohort program that had a minimum GPA requirement. How these participants accessed recognition from mentorship faculty and were possibly recognized by instructional faculty as influenced by their academic performance is not specifically consideredFuture work could expand the population to include a broader range of grades and could specifically consider academic performance alongside recognition.

Although the participants in this study represented varied demographic backgrounds, these social identities were not considered in relation to recognition from faculty. It is understood that

recognition is underwritten by systems of power as who gets recognized and for what practices can be heavily influenced by bias. While the participants in this study did describe experiences of recognition that intersected with their social identities, this purpose of this study was to understand shared experiences and was not designed to explore recognition and its intersections with their various social identities. Future work could specifically explore recognition from engineering faculty with a consideration of how bias may be both enacted by faculty and by students as they evaluate the value of faculty recognition. Future work could also include belonging theory with recognition to facilitate a deeper understanding of students' experiences of respect and disrespect as they join the community of engineering.

This study contextualized recognition experiences from instructional faculty and mentorship faculty but does not examine faculty recognition in undergraduate research experience. Future work could explore these experiences to better understand the nuances of meaningful recognition as it varies from context to context. Additionally, this work only considers students' first three years in an engineering program with limited consideration of changing recognition experiences over time. Future work could facilitate an understanding of students' experiences across an entire undergraduate program and orient these findings with students' time in their programs to support the development of curricular practices and approaches that are temporally relevant.

8 Conclusion

This work explored how undergraduate engineering students experienced the recognition of their engineering identities by engineering faculty during their first three years in an engineering program. Recognition as situated within engineering role identity was used with directed content and thematic analysis to identify three main themes that included how participants valued recognition from faculty, how they felt seen as in-progress, and how they perceived recognition as respect. A synthesis of these themes in the context of instructional and mentorship faculty illustrated how the participants in this study felt being seen as engineers-in-progress was treated differently through respect and disrespect. These findings extend existing work framing faculty as meaningful others, connects interpretations of recognition with identity, and establishes the respectful treatment of students as part of supporting students in their engineering identity development. This work presents specific suggestions to faculty in how they could meaningfully recognize their students and offers suggestions on ways larger programs can consider how identity can be supported through curriculum and practices that extend beyond assessment and teaching tools.

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