Work-In-Progress: Exploring the wellness perceptions of engineering and science faculty

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Work-In-Progress: Exploring the perceptions of engineering and science faculty on health, well-being, and thriving

This work-in-progress research paper explores faculty's experiences during their own undergraduate programs, as well as the role of health and wellbeing in their success as students. The culture of stress and hardship promoted in engineering education has been scrutinized as negatively affecting students, especially those from marginalized groups. However, little is currently known about the interactions among multiple actors in the engineering education ecosystem and their contributions to perpetuating such culture. Faculty directly impact students' experiences in engineering programs through first-hand interactions with students. These interactions can propagate professional beliefs and attitudes that our graduates instill and further propagate. Thus, faculty may be re-enacting attitudes that they learned through their own experiences as students. Therefore, their beliefs might bring insights into elements that have been persistent in the engineering education narrative.

In this work in progress paper, we use the model of engineering thriving to analyze interviews with four engineering faculty and analyze the transcripts using inductive and deductive thematic analysis. This study is part of a larger project to contribute to the efforts to evolve engineering's current culture of hardship and suffering to one that recognizes health, wellbeing, and thriving permeating essential academic spaces like the classroom. In this project, we seek to understand faculty conceptualizations of health and well-being that developed through their undergraduate and graduate experiences.

Our preliminary results show that the undergraduate experiences of faculty included elements of thriving and well-being such as self-knowledge and self-control. Some identified key turning points in realizing their best strategies to maximize their well-being and academic success, which enhanced their decision-making abilities. Furthermore, some participants achieved academic success despite poor well-being and thriving outcomes, which raises questions about the cultural and systemic factors that promote such dualism. In terms of the messages they received about well-being, faculty recognized the absence of explicit messages but acknowledged the existence of institutional structures that could support them if necessary (such as counseling services or professional societies). Finally, when comparing their experiences with those of current undergraduates, faculty identify issues with excessive technology, imposter syndrome, low extracurricular engagement, and low functionality among the elements against the newer generation's wellbeing.

Keywords: engineering culture, health, wellbeing, faculty, student success.

Context

The ongoing mental health crisis in U.S. colleges and universities [1] has only been exacerbated by current societal challenges such as the COVID-19 pandemic [2] and racial reckoning [3]. In response to these exacerbated challenges, university programs have increased scrutiny of professional cultures that promote or limit student wellbeing. Undergraduate degree programs such as medicine, nursing, and counseling [4] were among the first to critically examine the impact of their practices on their students and their future practice. In recent years, engineering

education has begun the discussion on the impacts of engineering culture of stress and endurance on student identity development and well-being especially those from marginalized groups [5]. Recent quantitative studies have shown evidence of high self-reported levels of stress, anxiety, and depression among engineering students, with higher levels of stress and anxiety among female students, and higher levels of depression among first-generation students [6]

Professional cultures include values, customs, behaviors, beliefs, and attitudes [4]. These cultures are defined and promoted within a particular university program by different players. In the case of undergraduate engineering programs, faculty play an important role in shaping the culture, since they are long-term members of the system who directly interact with students. Each interaction with students, in and out of the classroom, is another opportunity to promote beliefs, values, and attitudes that embody engineering culture.

Since engineering faculty are among key stakeholders who shape engineering culture, exploring faculty perceptions of the role of well-being in academic success in engineering is crucial to understanding elements of the engineering culture that interact with well-being. Thus, this project aims to explore engineering faculty's experiences during their own undergraduate and graduate programs, as well as their perceptions of health and well-being as they were acculturated into their degree program. This study is part of a larger project that aims to generate a systemic multigenerational understanding of the engineering professionalizing culture and the challenges of infusing health and wellbeing. In the first stage of our project, we will generate an in-depth qualitative exploration of faculty experiences with well-being. In the second stage, the qualitative results will inform a larger quantitative exploration of such experiences through large-scale surveys, targeting a sample of at least 300 current engineering faculty. This work-in-progress paper reports findings from the first stage of our project and is guided by the following research questions:

RQ1. Which elements of wellbeing and thriving were part of the undergraduate experiences of current faculty?
RQ2. Which messages did current faculty receive from faculty during their undergraduate experiences about the relevance of well-being to their academic success?
RQ3. Which similarities and differences do current faculty identify when comparing their experiences to those of current undergraduate students in terms of well-being and thriving?

Theoretical framework
Given the focus of this exploration on the undergraduate experiences of current faculty, we are using Gesun et al. [7] model for *engineering thriving*, which identifies various cultural, environmental, personal, academic, social, and contextual factors "that allow [engineering students] to function optimally in their academic, social, and personal experiences in engineering programs" [pp. 940]. The model was developed based on feedback from engineering faculty, staff, and administrators and is composed of three broader categories:
    (1) Internal thriving competencies – which are intrinsic to the individual

(2) External thriving outcomes – which reflect the desired results of applying internal competencies under favorable systemic and environmental conditions

(3) Engineering culture, systemic factors, resources, context and situation – which refers to the myriad of environmental and contextual factors that impact the relationships between developing internal thriving competencies and achieving external thriving outcomes;

Table 1 describes the specific elements of each of these three aspects of the model.

Table 1. Summary of dimensions of the engineering thriving model based on consensus from experts

Model Dimension	Areas
(1) Internal thriving competencies	a. *Behavioral* – actions and habits deployed in response to situations or stimuli b. *Cognitive* – thinking, reasoning, knowledge transfer, and associated mental processes c. *Intrapersonal* – relationship with oneself, interpretation of external situations and stimuli d. *Social* – Clear communication of information to others and appropriate interpretation of others' messages
(2) Engineering culture, systemic factors, resources, context and situation	a. *Cultural and systemic factors* – "root causes" influencing students' opportunities and ability to thrive within the undergraduate engineering system. b. *University resources* – capital, assets, affordances, and environmental factors affecting students' access to support and enrichment opportunities within the university or program c. *Personal context & situation* – Life circumstances influencing students' responses during their undergraduate experiences d. *Engineering Student Entry characteristics* – Students' input profile or previous experience when entering their program.
(3) External thriving outcomes	a. *Community & relationships* – building and maintaining positive connections and belonging to a network of support. b. *Health & Wellbeing* – maintaining a state of multidimensional well-being that supports student successful functioning in their program responsibilities and their personal life c. *Character & Persistence* – positive character traits and virtues resulting from continuous development and application of internal thriving competencies. d. *Academic & Professional* – Achievement of educational goals involved in an undergraduate engineering degree and professional career.

Adapted from [7]

Methods
Data Collection
To recruit participants, we used purposive sampling to reach out to a faculty listserv at a large public institution in the U.S. Northeast, as well as through national organizations. Faculty who were interested in participating reached out to the principal investigator, who made arrangements for the interview to take place. The first author conducted virtual hour-long one-on-one interviews with participants and audio-recorded the Zoom conferencing platform. The audio was professionally transcribed, and later validated for accuracy and complete anonymization by the first author. All research protocols were approved by the IRB at University at Buffalo.

The interview protocol explored faculty's experiences with well-being, physical and mental health, and stress management while they pursued their undergraduate and graduate degrees. The interview protocol is included in the Appendix. This exploration continued into participants' current practices as engineering faculty and their perceptions about their students' strategies for managing their physical and mental health, and stress. While the interviews focus on well-being and physical and mental health, several additional elements of the undergraduate experience were highlighted during the interviews that made the model of engineering thriving a suitable framework for the interview analysis. At the time of writing, we have collected data from five qualitative interviews and completed the analysis and reporting of four interviews in this work in progress paper.

Data Analysis

In this paper, we focus exclusively on the faculty's experiences in their own undergraduate programs and the comparison between their own undergraduate experiences with their perceived experiences of current undergraduate students. To conduct this study, we used an exploratory qualitative approach in which we used thematic analysis [8]. To answer our first research question, we used a deductive thematic analysis using the model of engineering thriving as a codebook. For that purpose, we exclusively focused on the participants' undergraduate experiences using a coding structure based on the model of undergraduate student thriving. For the second and third research questions, we used an inductive approach in which no codes or themes were established upfront but codes were identified organically from the data [9].

The coding was performed only by the first author, which is a limitation of this work-in-progress. Coding by another researcher will be included in the larger project and interrater reliability calculations will take place. Another limitation of this study is the self-selection bias of participants. Only faculty interested in this study chose to participate, which might bias findings toward the perspectives of faculty who have higher baseline interests in the intersection of wellbeing and student success than the general population.

Preliminary Results

Recall that the first four interviews conducted during the first phase of the larger project were used for the analysis we present here. Of the four participants, two identified as women and two identified as men. Their years of experience ranged between 3 and 12 years. Three of the participants were in teaching-focused positions, while one was in a traditional tenure-track role. One of the participants was foreign-born, while the rest were U.S. born. Two of the participants were faculty in computer science departments and the other two taught in traditional engineering departments. To protect participants' anonymity, the pseudonyms of our participants are Bruce, Lila, Abner, and Esther. Acknowledging that the participants' characteristics and their undergraduate engineering education context influence their experiences [10], we offer a summary of such characteristics in Table 2.

Table 2. Characteristics of participants and their undergraduate institutions.

Pseudonym	Sex	Race	Intl. Status	Characteristics of undergraduate institution
Bruce	Male	White	Domestic	Private, Highly Selective, Small Liberal Arts College
Lila	Female	White	Domestic	Private, Less selective, Small R2
Abner	Male	Asian	International	Non-US, nationally well ranked
Esther	Female	White	Domestic	Private, Highly Selective, Large R1

RQ1. Which elements of wellbeing and thriving were part of the undergraduate experiences of current faculty?

Behavioral, cognitive, and intrapersonal competencies were identified among the internal thriving competencies in faculty accounts of their experiences, as well as Community & Relationships and Health & Wellbeing. From their experiences as undergraduates, the participants can be grouped based on their thriving experiences. First, Abner was an example of somebody who thrived throughout his undergraduate experience and did not report any relevant hurdle to having a balanced and successful undergraduate experience. He attributed his experiences to exercise, and in particular to a martial art. On the other hand, Bruce and Esther both referenced facing challenges to balancing their academic success and their health and wellbeing. They both mentioned turning points that made them realize the connection between their academic success and well-being and how such realization influenced their subsequent actions. Finally, Lila's experience offers insights into a dualistic nature of undergraduate thriving, in which she achieved academic success but neglected her well-being and health, accumulating some unhealthy habits which had a significant impact on her long-term wellbeing. Such dualism brings important points to consider when analyzing thriving processes in undergraduate engineering education.

While three of the participants referred to physical activity to improve mental function, Abner brought important points about the specific practice of a martial art which supported his *Self-knowledge & self-control* (Behavioral & Cognitive competencies)

> "I started ... participating in a martial art that focuses on self and self building and not just physical improvement, but also mental improvement. And so that definitely has helped with overall state of mind, overall, I would say calmness, being able to observe that and, and avoid that and, you know, be a little bit more realistic. I think, that overall reduces that stress a little bit, you know, quite a bit."

He credited his martial arts practice to his ability to manage stress as an undergraduate student and preparedness for his graduate studies.

Both Bruce and Esther made explicit references to episodes that made them realize the **connection between their well-being and their academic success** (Health & Wellbeing), which made them more **purposeful decision makers** (Cognitive competencies). They realized that

sometimes what is recognized as "working harder" attitudes, such as suppressing distractions and cutting rest, were not necessarily the most appropriate approach for their success. And how integrating non-academic activities into their schedule supported their later focus on academic activities and achieved better results. Bruce decided to reduce his credits in his junior year by dropping his second major and engaging in sports and other extracurricular activities, he stated that it resulted in a more productive approach to learning:

> *"that was a very eye opening that I did better if I didn't try and work as hard. Because things like when I had more activities that were there, it made it easier to focus on working for just that time. And then it was actually a reward for getting it"*

Similarly, Esther mentioned a day when she wanted to skip her competitive sports practice because of the multiple engineering exams and commitments she had the next day. After deciding to attend, she realized the power of stepping away and re-energizing:

> *"that day taught me that like sometimes what you really need is to step away and go [sport] or get exercise or something like that."*

Esther recognized that there were a lot of ***stereotypes about learning engineering*** (Cultural and Systemic factors) that she believed when she was an undergrad. She mentioned the need to study non-stop over the weekends to succeed in exams despite knowing that such approaches would not work for her because her brain would not function under such an approach.

In addition, Bruce and Esther discussed multiple extracurricular activities that balanced their time as undergraduate students. In particular, Esther mentioned the profound positive effect that the Society of Women Engineers (SWE) had on her:

> *"No, I think extracurriculars are important just to like meet people and do something else besides school. Like to me [sport] and being a member of the Society of Women Engineers and just like being involved in directing my energy at something else was just like a key to my wellbeing and like interacting with people and having things to do."*

This quote denotes the essential value of Community & Relationships.

Finally, the case of Lila showcased the paradox of functionality vs wellness. She acknowledged that she was a ***functional undergraduate*** (Academic & Professional), turning in high-quality work and achieving her expectations. However, she also recognized that her behaviors were not healthy, as she summarized:

> *"lots of parties, lots of overworking and overextending myself between a part-time job, taking 20 credits a semester and being involved in activities and going out. Not a healthy lifestyle in terms of workload or…sleep"*

In addition, she started to have issues with alcohol consumption *"as an undergrad, I got away with showing up to class drunk all the time with alcohol even."* While these decision-making behaviors were unhealthy, she recognized that she could get away with those actions as an undergraduate. The setting of her undergraduate education did not pose any challenge for her to get noticed *"...with some level of they don't want to know, potentially. So I think that would be one of the bigger differences is, it's easier not to get caught, that things weren't okay. So you*

didn't have to deal with them." which could denote cultural and systemic factors that might be worth exploring.

RQ2. Which messages did current faculty receive from faculty during their undergraduate experiences about the relevance of wellbeing to their academic success?

Faculty in our sample could not identify explicit messages they received from faculty while they were undergraduate students regarding the relationship between their wellbeing and academic success. However, they were able to identify ***university resources*** they had available to pursue their mental health and well-being. These resources include counseling, suicide prevention training, and extracurricular organizations like SWE. Within their summary, the two main types of support that we distinguished in the participants' answers were those related to the given ***institutional structures*** and ***reactive resources***. For example, Bruce acknowledged that the structure of his small liberal arts college allowed him to feel cared for:

> *"...I always felt a certain amount of their caring. Yeah. I mean, part of it, my undergrad was a small setup. Like it was not uncommon at the end of the semester a professor would be like, "Hey, I'm gonna have all of you over to my house for a meal." For like the class of 30 students. I mean, that, that type of thing is different. Like always willing to help. Always willing to like... There was a huge amount of interaction. So it wasn't like a professor's on a pedestal. It was very much first name basis with pretty much everyone you ran into in these like departments. So it was a very, it was a friendly setup."*

While he did not get direct messages about the relevance of well-being and its interaction with academic success, the caring that faculty conveyed made him feel like he could reach out if necessary. Similarly, Esther referred to having a SWE advisor that could be of support and recognized their issues with well-being. On the other hand, Lila and Abner showcased the existence of institutional resources that were used when considered necessary, despite the wellness topic not being part of the classroom conversations:

> *"it wasn't talked about, nope. The only time that it came up was, I did some suicide prevention work after as a way of coping with one of my friend's suicides."* While Abner, which undergraduate took place in another country declared *"I think perception… was… a little bit of a taboo … you have to be dealing with some serious issues before you want to take that route [of counseling]. And it was not like, you know, as advertised or focused as, you know, students, you should, you should take care of yourself. Like maybe in general sense, it was, but again, not as focused, not as, as important as, you know, we consider now here."*

RQ3. Which similarities and differences do current faculty identify when comparing their experiences to those of current undergraduate students in the terms of well-being and thriving?

Participants' answers in this area offered insights into two different aspects of external thriving outcomes, which were Health & Well-being, and Community & Relationships.

Regarding Health & Well-being, Lila referred to her previous insight into differentiating functionality from healthy habits. In her view, the new generations of students have more healthy habits but lower functionality, in her words:

> "So surprisingly, these students, they take better care of themselves than you'd expect....These students don't know how to work hard or play hard, let alone work hard play hard lifestyle... So they have better habits in terms of functional health, but not as good in terms of functionality. In terms of them actually getting all their work done, and time management, and quality of work..."

On the other hand, Bruce recognizes that imposter syndrome is an increasingly relevant issue in the younger generations:

> "So in general, I feel like the biggest thing they run into or... Maybe not the biggest, but one thing that always comes back to me is imposter syndrome. And very much from the fact that there has been a huge shift."

In addition, Abner and Esther mentioned shifts in students' ability to build community, in particular, Abner pointed to the effect of technology saying:

> "...this might sound cliche, but... I do think that... excessive use of technology and access and connections might really reduce the human interactions. It might just be a deformation, but it might be also reduction... So I think technology, internet, you know, TikTok, YouTube, whatever that it is, Instagram, can take the same amount of time that you would've otherwise spent maybe with your friends, but they don't give you the same support that they would. Um, 'cause that time is basically building something which didn't, you know, long run, supports you, uh, passively and actively."

On a similar note, Esther pointed out *"I have noticed as a difference is like the amount of activities that I and my fellow students as an undergrad were involved in compared to the activities that the undergrads I encounter at UB are involved in."* Although she acknowledges that such differences might interact with the type of institution and student populations that distinguish such institutions.

Conclusion and Future Work

In conclusion, our preliminary results showed elements of well-being and thriving during the undergraduate experiences of faculty, including self-knowledge and self-control. We reported key turning points where they realized healthy strategies to maximize their wellbeing and academic success. Participants generally used strategies to re-energize and refocus on academic efforts to enhance their decision-making. Another result showed a paradox between academic success and function while hiding a poor well-being lifestyle, which brings questions about the cultural and systemic factors that promote such dualism. In terms of the messages they received about wellness, faculty recognized the absence of explicit messages but acknowledged the existence of institutional structures that could support them if necessary. Finally, when comparing their experiences with those of current undergraduates they identify issues with excessive technology, imposter syndrome, low extracurricular engagement, and low functionality

among the elements against the newer generation's wellbeing. In our future work, we will expand our analysis to participants' experiences in graduate school as well as connect their experiences to their current practices as faculty. In this work in progress, we seek feedback from the community in this early stage of this project.

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Appendix

Let's go back in time to when you were working towards your degrees,

- Was there ever a time when you were not able to take care of yourself physically or mentally (.e.g unable to cope with stress, etc.)
    - o If none:
        - How important do you think was your physical and mental health to you as student?
        - How did you use to take care of yourself physically?
        - How did you use to take care of yourself mentally and emotionally?
        - How do you think your physical and mental health were related to achieving your academic goals?
- How did that impact your academic goals?
- Which strategies did you use?
    - o How do you remember having dealt with stress while you were an undergraduate?
    - o How do you remember having dealt with stress while you were a graduate student?
- While you were an undergrad, what you think was the perception of your professors about the role of wellbeing in your academic success?
- While you were in graduate school, what do think was the perception of your advisors/supervisors/mentors with respect to the role of wellbeing in your academic success?

Now let's think of the present time, with respect to your current life and practice as an engineering professor and the interactions with your students,

- This first question is broad, so feel free to tackle it as you wish.
    - o How do you define wellbeing?
- How do you procure your wellbeing in your life as faculty?
- How do you manage stress as an engineering faculty?
- How do you maintain your physical and mental health?

Let's talk about your students

- What role, if any, do you think wellbeing has in the ability of your students to achieve their academic goals?
- What strategies are you aware your students use to take care of their wellbeing?
- How effective do you think are those strategies?
- How do you currently support your students' wellbeing?
- What structures of support are you aware are available at your institution for your students to maintain or support their wellbeing?

    If interviewee doesn't talk about stress:

- What is your perception of students' strategies to dealing with stress?
- In which ways the challenges this generation of undergraduate students are similar to what you experienced?
- In which ways the challenges this generation of graduate students are different to what you experienced? (if applicable)
- Would you like us to use a particular pseudonym for your case in our report?