

How Participating in Extracurricular Activities Supports Dimensions of Student Wellness

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Abstract— This study explores how engineering students perceive the benefits of extracurricular and co-curricular participation through the lens of dimensions of wellness. First-year engineering students at a large Midwestern research university were surveyed about their extracurricular experiences. Open-response data from 557 survey responses were analyzed using thematic analysis assisted by natural language processing to identify themes in how students describe the benefits of their participation in terms of dimensions of wellness. Students most frequently describe social, occupational, and intellectual benefits of participation. Findings characterize trends in these descriptions holistically and across different types of activities (e.g., recreational, professional, technical). These trends suggest ways to support students through extracurricular participation, communicate its benefits, and help students navigate choices in selecting beneficial activities to support their well-being, learning, and professional development.

Keywords—extracurricular, co-curricular, student experience, mental health, experiential learning, professional development

I. INTRODUCTION

This research paper investigates how engineering students perceive the benefits of participating in extracurricular activities (including student organizations, co-curricular activities, jobs, and other out-of-class activities). We examine these perceptions with respect to dimensions of wellness, ranging from social and emotional wellness to intellectual and occupational wellness. The need to support student wellness and mental health has continued to gain attention as increasing stressors and expectations of college students have contributed to a crisis of mental health across college campuses [1], [2]. Engineering students face additional stress from overloaded curriculum and competitive environments – a ‘meritocracy of difficulty’ that praises working hard at the expense of self-care, leading to ‘an equating of learning with suffering and shared hardship’ [3]–[7]. Educators can contribute to shaping this culture in how they convey norms and expectations about engineering and engineering education [8]. Along with efforts towards cultural change, wellness initiatives and programs are necessary steps in support of student wellbeing, learning, and retention to STEM careers [8]–[11]. These efforts in support of engineering student thriving can include how educators model wellness for students, integrating wellness into engineering curricula through specific interventions, or partnerships with the community, campus professionals, or student organizations in support of wellness [8], [12]. As an existing potential avenue for this support, extracurricular and co-curricular participation has been linked to

various dimensions of student wellness, including mental health, thriving, community, and motivation to persist [13], [14].

Participating in extracurricular and co-curricular activities (hereafter extra-/co-curricular activities) has been associated with students’ sense of belonging, professional development, and retention and graduation [15]–[18]. By participating, engineering students can connect to networks of peers and mentors [19], [20], increase sense of belonging in their discipline [20], [21], facilitate intellectual and interpersonal skill development [22]–[24], and have experiences that inform career planning and professional development [25]–[27]. Students’ choice of extra-/co-curricular participation also provides opportunities for students to tailor their educational experiences to personal interests and career aspirations. These identified outcomes of participation align with aspects of students’ well-being, including intellectual, occupational, social, and emotional wellness [28], [29]. Given these associations between extra-/co-curricular participation and wellness, this study contributes to articulating the nature of these connections from students’ own perspectives; it further examines the ways in which different activities support specific aspects of wellness, including managing stress, connecting with community, pursuing career goals, and providing a sense of purpose.

We analyzed qualitative survey responses from first-year engineering students about how they perceive the benefits of their participation in extra-/co-curricular activities. Given that many students participate in more than one extra-/co-curricular activity [30], we collected responses about students’ experiences in their top one or two activities to capture how students build profiles of participation through a range of experiences. We utilized thematic analysis assisted by natural language processing (NLP) to analyze open-ended text responses from 557 students at a large, public research university. This study helps to identify the breadth of perceived benefits of extra-/co-curricular participation and to articulate specific ways that students can pursue wellness through different types of extra-/co-curricular activities. Students’ open-ended responses provide nuance to current understanding of extra-/co-curricular participation, helping us to characterize the landscape of students’ extra-/co-curricular participation and trends in how students describe its benefits – identifying various ways that students make sense of their college experiences and the ways they are utilizing extra-/co-curricular participation to meet specific needs for well-being, growth and development. These findings can help educators to discuss the benefits of various types of extra-/co-curricular participation with future students.

Educators can support students in navigating choices of time allocation to identify what kinds of experiences may be useful to individual students and aligned with their personal interests and goals. By understanding connections between participation and various dimensions of wellness, educators can further guide students to maximize these experiences for growth, connection, and professional development.

A. Research Questions

This study addresses the following research questions:

(1) How do students describe the benefits of participating in extra-/co-curricular activities? In what ways do their descriptions relate to dimensions of wellness?

(2) What are the trends in how students describe the benefits of extracurricular participation by type of extra-/co-curricular activity?

II. BACKGROUND

Extracurricular and co-curricular activities include a variety of out-of-class opportunities, such as student organizations, undergraduate research, campus programs, and jobs. Co-curricular activities generally include those that have a link to academic courses or are discipline-related, such as service learning or professional societies, while extracurricular activities describe other student activities, such as social organizations, band, or athletics [18]. We consider both categories of activities together, reflective of how students consider their extra-/co-curricular options holistically in choosing how to allocate their out of class time [30], [31]. Engineering students' extra-/co-curricular participation most frequently includes combinations of technical, professional, and recreational activities (also conceptualized as engineering and non-engineering activities), in addition to jobs [30]–[32]. Technical activities include activities such as design competition teams and undergraduate research, and professional activities include engineering professional societies and engineering identity-based organizations, such as women in engineering programs. Recreational activities include activities such as sports teams, music and dance, and hobby-related organizations. Participation in both engineering and non-engineering activities have been linked to distinct outcomes, including leadership and competency development, academic engagement and persistence in engineering [33], [34]. These effects of participation have been found to be mediated by quality of involvement, as measured by extent of engagement and peer interactions within the activity [14].

In considering extra-/co-curricular participation, much focus has been placed on engineering students' participation in co-curricular activities (that is, engineering-related activities linked to curriculum) [32], [35]–[37]. Co-curricular participation contributes to experiential learning in engineering, developing professional competencies and networks, and increasing self-efficacy and sense of belonging in engineering [15], [27], [34], [35]. Notably, many engineering students participate in non-engineering extracurricular activities as well [30], [31]. Extracurricular (or non-engineering) activities have been shown to provide distinct benefits to engineering students, in forming social connections, meeting needs for belonging, relieving stress, and facilitating academic engagement [21].

Extracurricular activities can provide a means for students to persist in engineering while also retaining and pursuing outside interests that sustain their motivation. Students can further explore connections and applications of engineering in areas of personal interest that may not be explicitly covered in the curriculum. These extra-curricular experiences can be leveraged for experiential learning and development with intentional support from educators and university professionals to encourage reflection and growth from these experiences [38]. This study synthesizes findings around both extracurricular and co-curricular participation to understand how students perceive their respective benefits and role in supporting student wellness, with implications for persistence and retention in engineering programs [20], [27].

Various factors inform students' selection of extra-/co-curricular activities, including short- and long-term goals for personal- and career-related outcomes, and how students perceive the expected benefits of these activities. For example, students describe primarily career-driven or future-focused reasons for joining engineering-related organizations, in contrast to more present-focused reasons (e.g., personal interest and meeting new people) for joining non-engineering organizations [18], [30], [39]. Students associated participation in engineering-related organizations with discipline-specific professional development, while they associated participation in non-engineering organizations (e.g., recreational and community activities) more with social engagement and general skill development, including interpersonal communication skills, leadership skills, and general business skills. This study expands on these broad characterizations of the benefits students seek in their extra-/co-curricular participation by examining engineering students' open-response descriptions of their participation to identify qualitative themes in how engineering students perceive the benefits of participation. We further examine connections between these perceived benefits and aspects of wellness to identify existing and potential avenues to support engineering student wellness.

III. CONCEPTUAL FRAMEWORK

Wellness is conceptualized as an optimal state of health and wellbeing, consisting of many interrelating dimensions, described by various models. Most models include dimensions of social, emotional, physical, intellectual, and spiritual wellness [10], [40]. These dimensions have been adapted for use in higher education contexts to support student wellbeing initiatives and programs (e.g., refer to [41]–[43]). We chose the eight dimensions of wellness framework [29] to guide our analysis given its use in higher education wellness programs and its comprehensive nature in reflecting the variety of reasons students provide for participating in extra-/co-curricular activities. Furthermore, it extends beyond other wellness schema to include financial and environmental wellness as distinct aspects that affect college student wellbeing.

The eight dimensions of wellness [29] provides a holistic understanding of optimizing wellbeing through eight interrelated dimensions: physical, emotional, social, spiritual, intellectual, occupational, financial, and environmental. (These dimensions are often depicted visually as eight interconnecting circles given their interrelated nature, e.g., [28].) Table I

provides additional descriptions of each dimension, with attention to the context of higher education. Descriptions were adapted from [40], [42], [43]. As we began to generate themes from our preliminary analysis of the open-response data (see methods below), we selected the eight dimensions of wellness model as a useful organizing framework to make sense of the various ways that students described how extracurricular participation met their goals and needs as college students. The identified themes from our data mapped well to the dimensions of wellness described by this framework.

TABLE I. DESCRIPTIONS OF WELLNESS DIMENSIONS

Wellness Dimensions	Description
Physical	Need for physical activity, sleep, and nutrition
Emotional	Coping effectively with life and satisfying relationships, stress management and mental health
Social	Developing a sense of connection, belonging, and support system
Spiritual	Sense of purpose and meaning in life
Intellectual	Recognizing creative abilities and expanding knowledge and skills
Occupational	Personal satisfaction and enrichment from one's work
Financial	Satisfaction with current and future financial situations
Environmental	Good health from pleasant, stimulating environments with access to clean air, water, and living

IV. METHODS

To investigate how students describe the benefits of participating in extra-/co-curricular activities, we collected survey data from first-year engineering students in which they described their participation and its benefits. To analyze the students' open-ended text responses, we conducted a thematic analysis [44], [45], assisted by a series of iterative, human-assisted NLP algorithms [46]–[48]. These algorithms facilitated the thematic analysis through data familiarization and in applying codes across this large text data set to identify themes and patterns in student responses.

A. Study Context and Participants

We administered the survey to undergraduate first-year engineering students at a large, public research institution. The institution has sizeable engineering and non-engineering student populations, as well as many engineering and non-engineering extra-/co-curricular opportunities. We distributed the survey in the Fall 2021 and Fall 2022 semesters to first-year engineering students through 16 sections of a required introductory engineering course, each with up to 120 students. Course instructors offered students up to one point of extra credit in the course for either participation in this study or an alternative assignment. We received 710 complete survey responses, with 78.5% of respondents reporting one or more extra-/co-curricular activity. Of students reporting extra-/co-curricular participation, 54.2% reported two top activities, with the remaining respondents reporting one activity. Table II presents participant information for the survey participants. The 'All Participants' column provides information for all participants who completed the survey. The 'Participants reporting 1+ activities' column provides information for those participants who indicated at

least one extra-/co-curricular activity in their responses, which is the subset of respondents whose data this study analyzes. In future work, we will expand this analysis to consider the barriers and disadvantages of participation for those who indicate that they are not participating in any extra-/co-curricular activities.

TABLE II. PARTICIPANT INFORMATION

Variable	All Participants (%)	Participants reporting 1+ activities (%)
Gender		
Women	26.3	27.8
Men	70.4	68.9
Genderqueer/Nonbinary	1.7	1.6
Prefer not to answer	1.8	1.8
Race/Ethnicity ^a		
Asian	23.7	23.5
Black/African American	2.4	2.2
Hispanic/Latinx	7.9	7.0
White	69.2	71.1
Another race/ethnicity	1.9	1.3
Prefer not to answer	4.1	4.1
Other		
International student	11.1	10.2
Extra-/co-curricular Participation		
Indicated Top Activity	78.5	100
Indicated 2 nd Top Activity	42.5	54.2
Indicated Employment	12.3	12.9
Types of Activities ^b		
Recreational		53.3
Technical		26.9
Professional		28.4
Community		18.0
Service		7.5
Job		3.8
N	710	557

^a Students were given the option to select all with which they identified, so the percentages sum to greater than 100. Given single responses in some categories and to avoid identification, some responses were grouped together in 'Another race/ethnicity'.

^b Activity types include students' top 1 or 2 activities, so the percentages sum to greater than 100. (e.g., A student who reporting participating in a recreational activity and a technical activity would be represented in both categories, while a student with a single community activity would be represented in just that category.)

B. Survey Instrument

In this study, we analyzed students' open-ended text responses to a set of questions about their extra-/co-curricular participation [49]. Given the large variety of available extra-/co-curricular activities in which students participate, the use of qualitative survey data provides a 'wide-angle lens' to investigate a breadth of perspectives around different types of extra-/co-curricular participation [50]. Students could participate in the survey at their own convenience of time and location without requiring a large time commitment to share their perspective, encouraging participation from a wide range of student voices. (The median time for survey completion for all participants was 13 minutes.) Survey respondents were prompted to describe their current participation in one or two extra-/co-curricular activities (defined in the survey to include student organizations, campus programs, research, jobs, or other activities outside of class), sharing the name of each activity or organization and what about their participation in each activity

was significant or impactful to them. Of the 710 complete survey respondents, 557 respondents indicated that they participated in at least one extra-/co-curricular activity and provided responses to the open-response questions about their participation. Students reporting two activities provided responses for each activity respectively, resulting in 860 total text responses about extra-/co-curricular activities and perceived benefits of participation. To analyze trends in participation across different types of activities, we categorized each reported activity as one of the following activity types: recreational, technical, professional, service, community, or job. We identified these activity types in our previous analysis of students' extra-/co-curricular participation; the categories were informed by students' descriptions of participation and their self-selected categorization from a broader list of potential activity types [30].

C. Data Analysis

To identify themes and trends in how students benefit from extra-/co-curricular participation, we analyzed our data using thematic analysis [44], [45], following Nowell et al.'s [51] guide for conducting a trustworthy thematic analysis. Figure 1 illustrates our iterative analysis process. After familiarizing ourselves with the data set and developing preliminary codes, we tested and refined the codes across subsets of 50 to 150 responses to iteratively develop a codebook, utilizing thematic maps to group codes and generate preliminary themes [44]. We then applied the final version of the codebook across the entire data set to refine and define our thematic findings. We implemented a series of iterative, human-assisted natural language processing (NLP) algorithms to facilitate data familiarization and developing and applying codes across the data set. Furthermore, after identifying themes across the entire data set, we then compared responses across different types of extra-/co-curricular activities (e.g., recreational activities vs engineering-related technical / professional activities) to identify trends in students' responses by type of extra-/co-curricular activity.

1) Data Familiarization: Clustering responses to generate preliminary inductive codes

We began to familiarize ourselves with the data by reading through students' responses. To assist in this process of data familiarization (the initial phase of thematic analysis), we utilized Katz's algorithm for agglomerative clustering of text data [46]. This algorithm split responses by sentence and grouped together sentences that addressed similar topics. We chose to group responses at the sentence level since responses containing multiple sentences tended to convey multiple ideas. Splitting by sentence helped to identify distinct ideas, making the resulting clusters easier to interpret. Grouping together similar responses facilitated identifying connections and patterns across many responses and in gaining a sense of the domains of topics addressed in student responses. This process resulted in 80 clusters of sentences from student responses that conveyed similar ideas (e.g., meeting new people, learning technical skills, relieving stress), which we utilized to generate preliminary inductive codes for the data set. We reviewed the computer-identified clusters and labelled each cluster with a code that encompassed the topic of that cluster. Examples of codes generated from the clusters included: learn about a career in engineering, help other people, cross-cultural experience,

connect with older students on campus, and experience working as a team. We then further refined these codes to apply across the data set as described in the following sections.

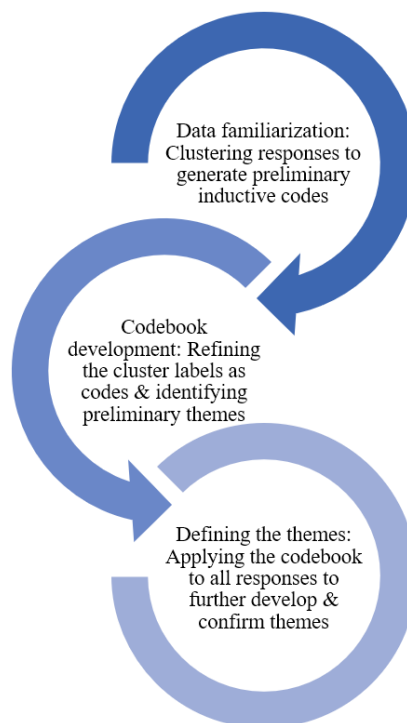


Fig. 1. Thematic analysis, assisted by iterative, human-assisted natural language processing algorithm

2) Codebook & Preliminary Theme Development: Refining codes through iterative coding & thematic mapping

After developing preliminary codes from the cluster labels, we refined the codes to develop a codebook of ways that students describe the benefits of extra-/co-curricular participation. We started with our list of inductively identified codes from the cluster labels. We then condensed and refined the wording of these codes and supplemented this list with additional codes from literature on extracurricular participation and the conceptual framework of wellness dimensions (described further in the following paragraphs).

We reviewed our codes and grouped them thematically for a more manageable number of codes to analyze themes and trends in responses. These groupings provided initial parent-level categories of codes, such as service, community, career exploration. We utilized Miro virtual whiteboard software to map relations between codes as we revised the codebook. We continued to refine the codes within each category for coherence, coverage, and compatibility with the NLP code labeling algorithm described in the final paragraph of this section. For example, we started with several codes that described social aspects of participating in extra-/co-curricular activities. We revised our codebook to include codes that described the variation in how students described seeking socialization (e.g., a group that is like family, a good group of

friends, looking to meet people like me, etc.). Similarly, we refined the initial list of codes that pertained to preliminary themes of professional development and career exploration aspects of extra-/co-curricular participation. We continued to review and synthesize codes with overlapping meanings, considering preliminary patterns and themes.

Additionally, we compared our identified codes to student development theory and literature on extracurricular participation to confirm agreement in how our codes described participation with the benefits identified in the literature (e.g., [52]–[54]). As we developed the codebook, we identified the eight dimensions of wellness model [28], [29] as a useful framework to organize our findings around different benefits that students perceive from their extra-/co-curricular participation. We thus organized the list of codes to each nest within one of the eight dimensions. For example, ‘keeps me healthy’ and ‘stay physically active’ fit within the physical dimension of wellness, while ‘learn about engineering work’ and ‘explore engineering interests’ fit within occupational wellness. We utilize these eight dimensions to analyze and present trends in findings.

With each iteration of this step, we applied the codes to a subset of 50 to 150 responses using the OpenAI GPT-3.5 API. The OpenAI GPT models are a series of large language models pre-trained for generative task purposes [55]. The GPT-3.5 model is further fine-tuned for instruction-based chat responses. We prompted the model to identify which codes from the codebook were mentioned in a student’s response, repeating this prompt for each student response. (All responses were de-identified prior to this step.) This step allowed us to apply one or more codes to each response in alignment with researcher-applied coding (in comparison to the above clustering algorithm that grouped each sentence to apply a single code). We then reviewed the codes applied by the algorithm, checking that the algorithm applied the codes from the provided codebook consistently and in agreement with researcher-applied coding. We revised the codes in the codebook, as well as added new codes, to address instances where we identified the algorithm to have ‘misabeled’ or ‘missed’ a segment of meaning. We iterated this process of refining the codebook with a subset of 100 responses until we reached 98% agreement between the researcher and computer-applied codes. We then confirmed the suitability of the refined codebook using a new (previously unlabeled) subset of 150 ‘test’ responses, achieving 95% agreement between the researcher and computer-applied codes. The use of NLP coding enabled us to efficiently modify the codebook, adding and refining codes to apply across the entire data set as we generated and reviewed themes.

Having determined our final codebook, we applied the codes to the entire data set of student responses for subsequent analysis. Table III illustrates how the codes were applied by the NLP algorithm in two example responses. In response to our prompt to the OpenAI GPT-3.5 API, the algorithm applied the codes listed in the ‘Codes Applied’ column to the given responses. According to our codebook, each of these codes nests within a wellness dimension, as indicated in the ‘Wellness Dimensions’ column. We utilized both the applied codes and respective wellness dimensions in analyzing trends in student responses.

TABLE III. EXAMPLES OF RESULTS OF NLP CODING

Example Text	Codes Applied	Wellness Dimensions
<i>I have been dancing my whole life and being able to continue to dance in college has been very important to me. Dance is a mental release for me, so having an outlet helps with the stress that can come with an engineering workload.</i>	relax / stress relief	Emotional
	continue previous hobby / activity from high school	Physical
	personal interest	Intellectual
<i>It's program is significant to me because it allows me to make connections with other women in the same STEM field as me while also getting the opportunity to get advice from graduates and professors. This program as helped me feel more at home on campus and also helped me find my path in engineering.</i>	women in engineering / STEM	Occupational
	community / support system	Social
	received advice	Intellectual
	helps me transition to college	Intellectual

3) Defining Themes and Analyzing Trends in Responses

To understand how students describe the benefits of their extra-/co-curricular participation (RQ1), we reviewed the most frequently applied codes within each wellness dimension. From these results, we defined themes around the various ways that students experienced the benefits of their participation. We reviewed themes with respect to the codes, filtering the data set by code and wellness dimension to synthesize and refine theme descriptions. We then compared trends across different types of activity (RQ2). For each activity type (recreational, professional, technical, community, service, job), we noted the proportion of students that described a benefit related to each wellness dimension. For example, for recreational activities, 50% of students in these activities mentioned a social wellness related benefit from their participation. We further selected a few illustrative examples from the open-response data to bring forward the students’ voice in these findings and provide context for the breadth of ways that students describe their extra-/co-curricular experiences. All names provided with quotes in the results section are pseudonyms.

V. RESULTS

Students describe the benefits of extra-/co-curricular participation across a variety of wellness dimensions, including social-, career-, and interest-related benefits. In the following sections, we use the dimensions of wellness framework to organize findings about how students perceive their extra-/co-curricular participation and its significance to their undergraduate experiences and wellbeing. We then discuss trends in how students describe the benefits of participation across different types of activities (e.g., recreational, professional, technical), providing exemplary student quotes to illustrate these findings in the context of students’ experiences in multiple types of activities.

A. Students described primarily social and occupational benefits of participation (RQ1)

To understand how students described the benefits of participation in terms of dimensions of wellness, we mapped the trends identified from students’ responses to each of the eight

dimensions of wellness from our conceptual framework (refer to Table I). These wellness dimensions include the following (in order of most to least frequently represented in the coded data): social, occupational, intellectual, physical, emotional, spiritual, financial, and environmental. As a reference to our theme development for this research question, Table IV presents the most frequently applied codes within each wellness dimension. The wellness dimensions are presented in order of most frequently labeled (i.e., the greatest number of codes applied fall within the social dimension, followed by occupational and intellectual, respectively). Students' descriptions of their extra-/co-curricular activities most frequently referenced aspects related to *social* and *occupational wellness*.

TABLE IV. MOST FREQUENT CODES BY WELLNESS DIMENSION

Wellness Dimension (Count of total codes)	Most Frequent Codes (Count)
Social (728)	• meet new people / socialize / make friends (201) • enjoy being with friends / hang out in fun club (98) • community / support system (85) • sense of belonging (84)
Occupational (634)	• learn about my engineering major / learn about engineering work (148) • supports my career goals / career preparation / helped prepare me for the future (118) • women in engineering / STEM (69) • real world engineering work / hands-on engineering work (67)
Intellectual (368)	• relevant to my engineering interest (105) • develop technical skills (59) • personal interest (57) • personal / character development (33)
Physical (235)	• stay physically active / keeps me healthy (118) • hobby / activity that is important to me (67) • continue previous activity from high school (50)
Emotional (165)	• relax / stress relief (62) • balance classes and fun / break from school (46) • do something I enjoy (31) • supports mental health (16)
Spiritual (116)	• community impact / positive impact / outreach (57) • volunteer / service / help other people (33) • faith organization (27)
Financial (36)	• job / employment / make money (36)
Environmental (8)	• eco- / environmental awareness / sustainability (6) • access to clean air, food, water (2)

1) Social benefits included both family-like communities and academic support systems.

Within the social domain, students described how their participation helped them to connect with peers for friendship and support. For many students, these activities provided a way to “meet new people and make new friends”, and for some becoming “a community to live life with”, “my family on campus”, “a home away from home”. Students described connecting with peers over shared interests, sports, career, faith, Greek life, culture, and more. Many students described social and recreational organizations in terms of family, home, and community. For example, Abby (pseudonym) described her rowing team as “my family on campus”: *“a team that is full of friendly, welcoming individuals that have made my experience at [this university] all the better. I spend upward of 3 hours a*

day with them and close to 10 hours with them on Saturdays. They have truly become my family on campus.” Abby and other students described participating in these activities in pursuit of specific forms of connection and community.

In a slightly different vein, students' descriptions of the social benefits of engineering-related professional organizations tended to center around providing support systems, academic community, and encouragement in academics. Austin described social support provided through his participation in the American Society of Mechanical Engineers (ASME): *“This club is a community of engineers who seek to solve problems together and provide support to each other’s academics. This group helps me get help for my education and provides insight on my future goals.”* Students also described how these communities encouraged their persistence in engineering. Alicia said, *“As a woman in a predominantly male field, having resources and a large community to encourage me and build confidence has been useful and a peace of mind if I ever have doubts about my identity in the profession.”* These quotes illustrate how students cultivate social wellness in different forms through their extra-/co-curricular participation. In some cases, this social wellness is integrated with occupational wellness in terms of how connecting with peers supports persistence in engineering, receiving advice about their major, and navigating career preparation.

2) Occupationally, students learned more about engineering and prepared for career interests through participation.

Within the occupational domain, students described how their extra-/co-curricular participation helped them to learn more about engineering work and supported their career goals. To this end, students frequently described both exploratory benefits (learning more about engineering) and preparation benefits (career preparation in terms of skill / professional development). For example, Josh said of his participation in ASME: *“It allows me to learn about what mechanical engineering is like and helps me develop skills such as CAD that will help me get internships and jobs in the future.”* Several students described participating in specific activities that were either “connected to my intended major”, “helped me research/identify which discipline of engineering I want to pursue”, or “get a better sense of the major”. Kathryn described various benefits to participating in an engineering-related student organization: *“This program has taught me information that will be very useful in my upcoming classes, and it gives me an idea of what working in my desired field will be like. The board is very supportive and make sure we understand all the concepts brought to us.”* Other students valued developing skills specific to their occupational interests or support in pursuing these career interests. Jake described his experience on an engineering design team in how it *“taught me about the ins and outs of being on a real design team. This club allows me to take the theory that has been taught to me and apply it in a real-life situation.”* Several students shared how they gained hands-on experience related to their career interests. For example, Adam said, *“This involvement is significant to me because I want to pursue a career working with rockets. This club provides me with an opportunity to get hands on experience as well as grow my knowledge in this particular subject area.”*

Benefits to occupational wellness overlapped with *intellectual* wellness for students pursuing engineering-related interests.

3) Interest-specific participation supports various other dimensions of wellness.

Pursuing personal interests (*intellectual wellness*) through extra-/co-curricular participation further supported students' wellness in other dimensions as they sought to balance school and personal life (*emotional wellness*), to pursue physical health (*physical wellness*), and to serve their communities, providing a sense of purpose (*spiritual wellness*). Many students describe participation in recreational activities as a 'mental release', 'creative outlet', 'great stress relief', or 'chance to de-stress'. Some students further link these activities back to supporting their academic success by encouraging time management or sustaining motivation. For example, Sam described his lacrosse club participation as '*an outlet from school and schoolwork*' and further said, "*Having a structured team has also allowed me to be a better student. To be able to go to all of the practices, I am motivated to complete all of the work ahead of time and complete it well, so I can get good grades.*" Similarly, Sara said that participating in club volleyball "*keeps me active which helps me stay motivated to complete my schoolwork.*" In addition to providing stress relief or a break from school, students valued their extra-/co-curricular participation for their ability to impact their community and help other people.

Of note, *financial* and *environmental wellness* were the least frequently coded wellness dimensions in this data set, raising questions about the limits and challenges of extra-/co-curricular participation for future research.

B. Identified benefits varied by type of extra-/co-curricular activity (RQ2)

To further examine how students experience these benefits within different types of activities, we examined the most frequently labeled codes by wellness dimension across each type of activity. In Table V, we present the most represented wellness dimensions for each activity type, determined by calculating the percentage of responses within each activity type that reference a given wellness dimension. For example, 50.1% of responses for recreational activities note a social benefit of participation. We then share the most frequently applied codes within each of these wellness dimensions by activity type.

We compared trends in how students describe different types of activities by wellness dimension. *Social wellness* is most frequently coded for recreational and community activities. Within this wellness dimension, 'meeting new people' is the most frequent code for both recreational and community activities, followed by 'being with friends' for recreational activities and 'sense of belonging' for community activities. Recreational activities are also frequently associated with *physical* and *emotional wellness* (coded most frequently as 'staying physically active' and 'stress relief', respectively), while community activities more frequently note *spiritual wellness* benefits (most frequent codes being 'faith organization' and 'community impact'). Technical and professional activities are both strongly associated with *occupational wellness*, along with *intellectual wellness*. Students more frequently note *intellectual wellness* benefits for technical activities (most frequent codes including 'relevant to my engineering interests'

and 'develop technical skills'), while professional activities have a greater proportion of responses coded for *social wellness* (coded as 'community / support system').

TABLE V. MOST FREQUENT DIMENSIONS OF WELLNESS BY ACTIVITY TYPE

Activity Type	Most Represented Wellness Dimensions (Percent of responses)	Most Frequent Codes by Wellness Dimension & Activity Type
Recreational	Social (50.1%)	• meet new people / socialize / make friends • enjoy being with friends / hang out in fun club
	Physical (49.0%)	• stay physically active / keeps me healthy • hobby / activity that is important to me
	Emotional (31.6%)	• relax / stress relief
Technical	Occupational (84.8%)	• learn about my engineering major / learn about engineering work • real world engineering work / hands-on engineering work • supports my career goals / career preparation / helped prepare me for the future
	Intellectual (63.7%)	• relevant to my engineering interest • develop technical skills
Professional	Occupational (83.5%)	• women in engineering / STEM • supports my career goals / career preparation / helped prepare me for the future
	Social (37.6%)	• community / support system • meet people with similar interests
	Intellectual (35.3%)	• received advice • relevant to my engineering interest
Community	Social (83.7%)	• meet new people / socialize / make friends • sense of belonging • community / support system
	Spiritual (40.4%)	• faith organization • community/positive impact / outreach
Service	Spiritual (61.4%)	• community/positive impact / outreach • volunteer / service / help other people
	Occupational (36.4%)	• leadership development/experience • supports my career goals / career preparation / helped prepare me for the future
Job	Financial (66.7%)	• job / employment / make money

To further illustrate these trends in our findings, we present two examples of student responses in Table VI. Both students report participating in two different types of extra-/co-curricular activities (combinations of recreational/technical and recreational/professional). Table VI includes each students' responses describing their extra-/co-curricular activities, followed by the activity type, codes applied, and associated wellness dimensions.

These responses reflect some of the broader trends found with respect to how students describe different types of activities, while also illustrating the variation in responses in how students experience extra-/co-curricular participation. For example, Brandon participates in intramural football and an engineering design team (recreational and technical activity, respectively). He shared several reasons that these activities are significant to him, serving distinct roles in his student experience. Consistent with our finding that *social* and *physical*

wellness are the most reported benefits of recreational activities, Brandon described football as both a physical and social outlet that provides continuity with his pre-college interests and activities. He said, “*Football has become a part of me and shaped who I am... a means for keeping me in shape and meeting new people.*” Furthermore, like other students’ responses about technical activities, he shares that the engineering design team provides *occupational* and *intellectual* benefits as he learns more about engineering through an activity he enjoys (working on cars). He said, “*It helps me network and introduces me to aspects of engineering.*” He also described a distinct *social* benefit of participating in this technical activity, in that it allows him to connect with other engineering students.

Danielle also described participation in a recreational activity, the rowing team. Like Brandon, she identified *physical* and *social* benefits of participation – exercising and meeting new people. Furthermore, she described *emotional* benefits: “*it allows a break in my day from studying which helps me mentally and physically.*” Danielle also participates in a women in engineering program, a professional activity. She said that she valued the connection with other women engineers and how this activity “*helped me feel more at home on campus and also helped me find my path in engineering*” (*social* and *occupational wellness*). In helping her transition to campus life and providing opportunities to receive advice, this activity also provided *intellectual wellness* benefits that supported her development as a college student. For both Brandon and Danielle, their participation in multiple extra-/co-curricular activities served specific roles related to their personal interests and career aspirations, with each activity supporting distinct aspects of their well-being and student success.

TABLE VI. ILLUSTRATIVE EXAMPLES FROM STUDENTS

Pseudonym	Survey Response (Activity Type)	Codes Applied	Wellness Dimensions
Brandon	This is important to me because I played football growing up. Football has become a part of me and shaped who I am. I have never not played football. Football is an outlet for me. It is also a means for keeping me in shape and meeting new people who are on my team. (Recreational)	stay physically active / healthy	Physical
		meet new people / socialize / make friends	Social
	This is important to me because I enjoy building and working on cars. This club allows me to do that. It also allows me to meet many more engineers as this club is full of engineers. It helps me network and introduces me to aspects of engineering. (Technical)	explore engineering interests	Occupational
		meet people in my major	Social
		network for future career	Occupational
		relevant to engineering interest	Intellectual

Pseudonym	Survey Response (Activity Type)	Codes Applied	Wellness Dimensions
Danielle	I practice with the team 6 days a week so it is a large time commitment. I really enjoy the opportunity to meet new people, socialize, and exercise. This sport is significant to me because it allows a break in my day from studying and classes which helps me mentally and physically. (Recreational)	stay physically active / healthy	Physical
		meet new people / socialize / make friends	Social
		balance classes and fun / break from school	Emotional
		supports mental health	Emotional
	It's program is significant to me because it allows me to make connections with other women in the same STEM field as me while also getting the opportunity to get advice from graduates and professors. This program as helped me feel more at home on campus and also helped me find my path in engineering. (Professional)	women in engineering / STEM	Occupational
		community / support system	Social
		received advice	Intellectual
		helps me transition to college	Intellectual

VI. DISCUSSION AND CONCLUSION

Consistent with previous findings about students’ reasons for selecting extra-/co-curricular activities [18], [30], [39], students most frequently describe occupational and social benefits of their participation. Engineering-related co-curricular participation was largely associated with occupational and intellectual wellness, and to some extent academically focused social wellness. These activities serve a key role in supporting students academically and in preparing for engineering careers [34], [35]. In addition, extracurricular activities serve a distinct role for many students in supporting other aspects of wellness that contribute both to their well-being and academic success. By affirming these non-engineering activities, students can situate their engineering interests with other diverse interests, connect with supportive communities, and identify productive ways to manage academic stress. Extracurricular and co-curricular activities need to be considered and utilized jointly to fully support engineering students and recognize their individual needs and interests. By expanding our understanding of available extra-/co-curricular activities, educators can guide students in enhancing their time on campus and fostering a culture of wellness, as well as help integrate their extra-/co-curricular experiences with curricular learning.

Broadly, these findings illustrate how extra-/co-curricular participation provides students agency to individualize and support their college experiences – pursuing experiences that fit their interests, meeting desired needs for connection or development, and supporting their journey as students and developing engineers. In many ways, the most consistent finding

about extracurricular impact is the extent to which this impact varies from student to student [20], [21]. The challenge of identifying generalized outcomes of participation can be attributed to the variety of available activities, variation in how students may engage with these experiences, and complexity of interacting experiences and individual contexts. While challenging to define, the varied nature of these experiences can be an asset to connect students with meaningful and motivating pursuits outside their classwork. These experiences are not necessarily equally beneficial, but opportunities exist to further support student learning to make the most of diverse experiences that interest or motivate them.

Delineating categories of potential benefits of extra-/co-curricular activities to students can help to frame choices around how they allocate their time to different types of activities and encourage students to explore available opportunities. These findings can help students consider how different activities might serve different needs for their education and wellbeing. Recognizing that engineering students most frequently participate in combinations of recreational, technical, and professional activities [30], our findings characterize these different types of activities by identifying the dimensions of wellness most frequently associated with each activity type (e.g., students describe social and physical benefits for recreational activities, and occupational and intellectual benefits for technical activities). These findings further ongoing work to identify connections between specific extra-/co-curricular experiences and personal and professional outcomes [35]. In future research, we plan to build upon these findings, developing a framework to further clarify how extra-/co-curricular participation and experiences impact students in ways that attend to their holistic well-being and development.

ACKNOWLEDGMENT

This material is based upon work supported by the National Science Foundation under Grants 1842166, 2142697, and 1505006. Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

We thank Tram Dang, Athena Lin, eugene mahmoud, Jocelyn Nardo, Alexander Struck Jannini, and Casey Wright for their helpful feedback.

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