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Promoting Equitable Career Awareness in a First-Year Biomedical Engineering Course

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Introduction

Underrepresented students in higher education, including first-generation college students (FGCS), often encounter structural and social barriers that influence academic success, sense of belonging, and persistence in science, technology, engineering, and mathematics (STEM) fields [1], [2]. Limited access to familial knowledge about navigating higher education and exposure to professional STEM careers may shape students' expectations and decision-making early in their academic trajectories [3]. Prior research highlights the first year of college as a critical period for supporting identity development, belonging, and persistence, particularly for students from historically underrepresented backgrounds [4], [5].

Career knowledge and professional awareness are important components of engineering identity development and motivation to persist in STEM [6]. Students' perceptions of engineering work, available career pathways, and required skillsets are shaped by early exposure to engineering practices and by social support from peers, instructors, and family members. Without deliberate intervention, students, especially early in the curriculum, may hold narrow or incomplete conceptions of engineering careers that persist over time [7], [8], [9]. Differences in access to professional role models and career-related social capital may further influence how FGCS and non-first-generation college students (NFGCS) develop these perceptions.

These challenges may be particularly salient in biomedical engineering (BME), a discipline characterized by a broad and interdisciplinary curriculum [10]. BME graduates pursue careers across industry, academia, healthcare, government, and related sectors; however, prior work has shown that undergraduate BME students often demonstrate limited awareness of the full range of career pathways and professional skillsets associated with the field [7], [8], [9]. Although students' career knowledge may broaden through coursework and experiential learning, many students early in the curriculum may lack awareness of available opportunities and expectations.

To address these challenges, engineering programs have increasingly implemented first-year courses aimed at introducing students to the discipline, promoting professional identity development, and supporting early career exploration. Such courses offer a scalable means of providing equitable access to career-related information early in students' academic experiences. While prior studies have demonstrated that targeted instructional approaches can improve students' understanding of engineering careers and professional skills [7], [8], less is known about whether FGCS and NFGCS students enter first-year BME courses with differing levels of career knowledge or whether such courses support comparable gains across these populations.

The purpose of this study is to examine how participation in a first-year BME course influences students' understanding of BME career paths, job titles and roles, and desired professional skillsets, with particular attention to differences between FGCS and NFGCS. Using pre- and post-course survey data, this work explores whether early, career-oriented BME experiences support equitable development of professional awareness among first-year students.

This study was guided by the following research questions:

1. Do first-generation and non-first-generation BME students report differences in their previous exposure to healthcare or engineering?
2. Are there differences between first-generation and non-first-generation BME students in their initial understanding of BME career paths, job titles and roles, and desired skillsets upon entering a first-year BME course?
3. Do first-generation and non-first-generation students demonstrate comparable changes in career knowledge and professional skill awareness following participation in a first-year BME course?

Cohorts

This study was performed within an ABET-accredited BME undergraduate program at an R1 university in the southern United States. Historically, the BME undergraduate cohort size has been ~55 students. In Spring 2024, 60 first-year BME students completed consent forms to be part of the institutional review board (IRB)-approved study (IRB #: 14861). An additional 63 first-year BME students completed consent forms in Spring 2025 as part of the same IRB-approved study.

BME 1421

BME 1421 is a required one-semester course specifically for first-year BME students designed to introduce the breadth of the BME discipline and support early professional exploration. The lecture-based course was offered over a 16-week semester and was implemented in Spring 2024 and Spring 2025.

During the first half of the semester (weeks 1–8), the course focused on orienting students to the BME major. Instruction began with an overview of BME as a discipline, followed by focused exploration of core BME areas, including biomaterials, biomechanics, and bioinstrumentation. Students were also introduced to common BME career pathways and engaged in structured discussions of the BME curriculum, including both required coursework and extracurricular opportunities that support skill development and long-term career goals. This portion of the course included a panel discussion with upper-level BME students, during which seniors share their academic experiences and career decision-making processes, as well as a research showcase in which undergraduate and graduate student representatives present ongoing BME research within the department.

The second half of the semester (weeks 9–16) emphasized BME applications through a team-based design project and targeted technical skills development. Students engage in the engineering design process, including problem definition, conceptual design, computer-aided design (CAD), and prototyping using 3D printing. Additional technical skill development included introductory activities in circuit design and basic instrumentation. While the overall course structure and learning objectives were consistent across offerings, the design project differed between academic years. In Spring 2024, the design project focused on developing a medical alert system for elderly patients in rural communities. In Spring 2025, the project centered on redesigning a syringe pump system fabricated from a commercial, at-home 3D printer, with emphasis on improving device

safety, including mitigation of hypodermic needle risks. Both projects required students to apply the engineering design process and engage in iterative prototyping and evaluation.

Online Surveys

Two cohorts of BME students completed online surveys via the Qualtrics platform as part of homework assignments for BME 1421 during the first and fifteenth weeks of classes in Spring 2024 and Spring 2025. Surveys were assigned as completion-based homework and graded solely on submission, not content. Research consent was collected separately by an individual not involved in course instruction or grading. Students were informed that participation was voluntary, would not impact course standing, and that the instructor would not have access to consent decisions. In accordance with IRB approval, identifiable survey data were not accessed for research purposes until after final grades were submitted; at that time, responses from non-consenting students were removed and all remaining data were deidentified prior to analysis.

Survey questions (**Appendix A**) focused on two major aspects: (i) student understanding of the career options available for BME graduates and (ii) their understanding of the skillsets and experiences needed for career options. The surveys used were the same for all students. In this study, student responses to four open-ended questions were analyzed. Written responses to open-ended questions were blinded and analyzed manually to identify frequently mentioned keywords and themes, as well as unique responses across the student cohorts.

Data Analysis

Data were deidentified prior to analysis. Data analysis comprised two stages: open coding and code categorization to identify trends. Open coding was used initially to complete systematic review of survey responses. Codes (i.e., words and/or short phrases) were created, based on input from multiple researchers to concisely represent and/or summarize the meaning of survey responses. Similar codes were then categorized into themes following coding of survey responses. A code was counted if it appeared at least once within the participant's response and any given code was applied only once per survey question per participant within a single survey.

Statistical Analysis

Data are expressed as the mean ± standard error of the mean, unless otherwise noted. Statistical analyses were performed using non-parametric tests. An aligned rank transform (ART) ANOVA was used to evaluate the effects of group (FGCS vs. NFGCS), time (week 1 vs. week 15), and their interaction. When significant interaction effects were observed, follow-up pairwise comparisons were performed using Wilcoxon signed-rank tests (paired) and Mann–Whitney U tests (independent) with Bonferroni adjustment. A significance threshold of $p < 0.05$ was used for all tests. P-values corresponding to the ART ANOVA are reported explicitly in the text (e.g., "ART ANOVA: p = …"), whereas p-values from follow-up pairwise comparisons are reported without additional labeling to maintain readability. Effect sizes (Cohen's d) were calculated for paired and independent comparisons. Analyses were conducted using SPSS (v. 31.0.0.0) and JMP (v. 19.0.3). Data are presented as box-and-whisker plots with mean (+), median, 25% and 75% percentiles (box boundaries), and range (whiskers extending to most extreme data points not considered

outliers) depicted. Outliers (defined as 1.5 times the interquartile range) are indicated by • and were not removed to keep the analysis conservative.

Results

Research Question 1: Do first-generation and non-first-generation BME students report differences in their previous exposure to healthcare or engineering?

Students were surveyed in Week 1 to better understand the types of healthcare or engineering exposure that was experienced prior to entering BME 1421. Within the total population of 123 students who consented to participate in this study, 21 self-identified as a FGCS, while 102 self-identified as a NFGCS. Written responses for unique previous experiences were analyzed and coded and codes were categorized into five common areas: previous high school courses, previous college courses, extracurriculars (e.g., clubs), jobs & internships, and access to family member in those fields. Analysis of the percentage of students who communicated a code in the previous experience themes was performed (**Table 1**). In this sample, FGCS more frequently reported exposure to engineering and healthcare through previous high school courses compared to NFGCS; however, FGCS and NFGCS described similar exposure through previous college courses. A higher percentage of NFGCS reported exposure through extracurricular activities compared to FGCS, while FGCS more frequently indicated exposure through jobs or internships. A higher percentage of NFGCS reported having family members in engineering or healthcare fields. Notably, first-generation status did not map directly onto prior exposure, as students in both groups described a range of experiences across all categories.

Table 1. Percentage of students identifying at least one code in career path previous exposure to healthcare- or engineering-relevant experience themes.

	High School Courses	**College Courses**	**Extra-curriculars**	**Jobs/ Internships**	**Family Member**
FGCS	48%	24%	24%	24%	5%
NFGCS	35%	19%	41%	14%	19%

Research Question 2: Are there differences between FGCS and NFGCS in their initial understanding of BME career paths, job titles and roles, and desired skillsets upon entering a first-year BME course?

Students in BME 1421 were surveyed in Week 1 to better understand the types of careers that FGCS and NFGCS initially think a graduate with a B.S. in BME can pursue. Written responses for unique jobs were analyzed and coded (**Appendix B, Table 3**). Codes were categorized into four common career paths: industry, academia, healthcare, and government. Analysis of the percentage of students able to identify at least one job within the four career path themes was performed (**Table 2**). FGCS and NFGCS reported that BME graduates can hold jobs in industry, academia, and healthcare. A similar percentage of students in both groups indicated that students can hold industry and healthcare jobs. A higher percentage of FGCS described that BME graduates can hold jobs in academia compared to NFGCS. In addition, a small percentage (1%) of NFGCS indicated that BMEs can pursue government careers, while no FGCS described government careers.

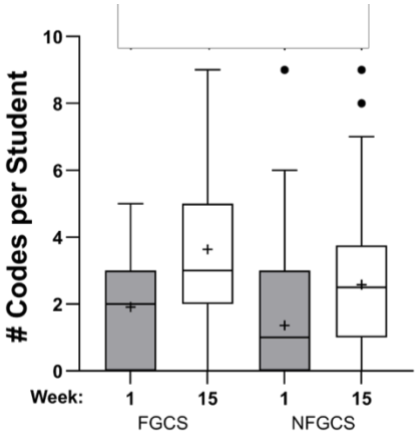

Figure 1. FGCS and NFGCS reported low, but similar, numbers of unique career pathways prior to taking BME 1421 (i.e., in Week 1; ART ANOVA: $p = 0.093$, Cohen's |d| = 0.11, negligible effect). Following the course, students demonstrated increased identification of career pathways (ART ANOVA: $p = 0.001$). This pattern was observed across both FGCS (Cohen's d = 0.87, large effect) and NFGCS (Cohen's d = 0.62, moderate effect), with similar values between groups at Week 15 (ART ANOVA: $p = 0.14$, Cohen's |d| = 0.41, moderate effect).

Student perceptions of jobs held by BME graduates after receiving their B.S. in BME were further investigated by examining written responses for unique job codes. FGCS identified, on average, 1.8 ± 0.4 codes per student, while NFGCS identified 1.6 ± 0.2 codes per student on average (**Figure 1**). A comparison between groups at baseline indicated similarities (ART ANOVA: $p = 0.093$), corresponding to a negligible effect size (Cohen's |d| = 0.11). The percentage of students who were able to communicate that BME graduates can hold jobs in two or more career pathway themes was similar between FGCS and NFGCS (FGCS: 65% of students, NFGCS: 64% of students). Further, the percentage of students who reported that they "don't know" of any jobs that BME graduates might hold was similar between FGCS and NFGCS (FGCS: 33% of students, NFGCS: 36% of students).

To better understand student knowledge of specific industry job titles and roles, students were asked to describe the job titles and roles for BMEs working to develop a new medical device. At the start of the semester, the average number of codes, where each code represented a unique job, title, or role in industry, was similar between FGCS and NFGCS, with FGCS and NFGCS reporting 0.2 ± 0.1 and 0.2 ± 0.1 codes, respectively (**Figure 2**; $p = 0.97$, Cohen's d = 0.01), corresponding to a negligible effect size. Research and development engineer and project manager were the most named roles by FGCS and NGFCS (**Appendix C, Table 4**). "Quality engineer" and "clinical engineer" were also named by NFGCS, albeit at a low frequency, but were not reported by FGCS. Notably, many students reported that they "don't know" of any industry job titles or roles in their survey responses (FGCS: 81%, NFGCS: 67%).

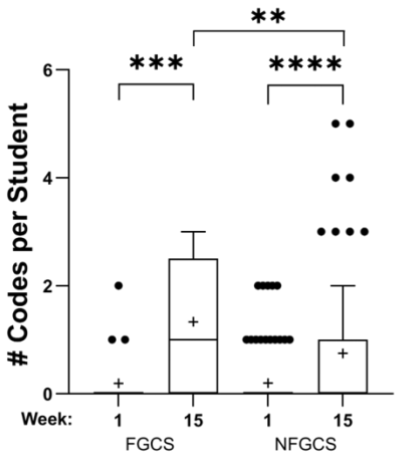

Figure 2. FGCS and NFGCS reported low, but similar, numbers of unique industry role or job codes prior to taking BME 1421 (i.e., in Week 1, $p = 0.97$, Cohen's d = 0.01, negligible effect). Following the course, students demonstrated increased identification of industry roles, with both FGCS ($p = 0.0004$, Cohen's d = 1.24, large effect) and NFGCS ($p < 0.0001$, Cohen's d = 0.51, moderate effect) demonstrating gains. At Week 15, FGCS identified a greater number of roles than NFGCS ($p = 0.016$, Cohen's |d| = 0.51, moderate effect), indicating larger gains for FGCS over time. ** = $p < 0.05$, *** = $p < 0.001$, **** = $p < 0.0001$.

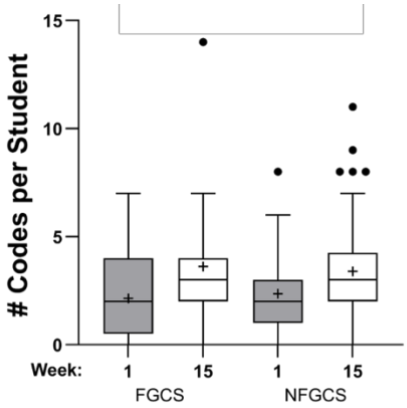

Figure 3. FGCS and NFGCS reported similar numbers of unique skillset and experience codes prior to taking BME 1421 (i.e., in Week 1; ART ANOVA: $p = 0.34$, Cohen's d = 0.12, negligible effect). Following the course, students demonstrated increased identification of skillsets and experiences (ART ANOVA: $p = 0.008$), with both FGCS (Cohen's d = 0.58, moderate effect) and NFGCS (Cohen's d = 0.56, moderate effect) showing gains. No differences were observed between FGCS and NFGCS at Week 15 (ART ANOVA: $p = 0.76$, Cohen's |d| = 0.10, negligible effect).

Skillsets and experiences that undergraduate students should obtain or pursue prior to graduation, as described by FGCS and NFGCS, were further assessed. Responses were coded and focused on technical skills, professional skills, knowledge, and experiences. At the start of the semester, FGCS and NFGCS a similar number of skillsets and experiences, where FGCS named 2.3 $\pm$ 0.5 codes per student and NFGCS named 2.4 $\pm$ 0.2 codes per student (**Figure 3**; ART ANOVA: $p = 0.34$, Cohen's d = 0.12), indicating a negligible effect size. Both FGCS and NFGCS identified a range of technical skills, professional skills, knowledge, and experiences that BME undergraduate

students should obtain or pursue prior to graduation (**Appendix D, Table 5**). While the majority of FGCS and NFGCS were able to name skillsets and experiences, 20% of FGCS and 19% of NFGCS specifically reported that they "don't know" of any skillsets and experiences that undergraduate students should obtain or pursue.

Research Question 3: "Do FGCS and NFGCS demonstrate comparable changes in career knowledge and professional skill awareness following participation in a first-year BME course?"

To assess the impact of the BME 1421 on student understanding of the career paths that BMEs can hold jobs, students were surveyed during the first and fifteenth week of classes (i.e., at the beginning and end of the semester). At the start of the semester, FGCS and NFGCS demonstrated comparable knowledge of the government, healthcare, academia, and industry jobs that BME graduates can pursue (**Table 2**). The percentage of FGCS that identified that BME graduates can obtain jobs in government, healthcare, academia, and industry increased to 10%, 25%, 70%, and 90%, by the end of the semester, respectively. The percentage of NFGCS able to communicate jobs that BME graduates can obtain similarly increased, where 10%, 20%, 54%, and 82% of students identified jobs in government, healthcare, academia, and industry, respectively by the end of the semester.

Further assessment of student perceptions of careers that BME graduates can pursue was conducted by examining written responses for unique job codes over time. Students demonstrated increased identification (ART ANOVA: $p = 0.001$) of career pathways following participation in BME 1421 (**Figure 1)**. FGCS increased from 1.8 ± 0.4 to 3.5 ± 0.4 codes per student (Cohen's d = 0.87, large effect), while NFGCS increased from 1.6 ± 0.2 to 2.6 ± 0.2 codes per student (Cohen's d = 0.62, moderate effect). Patterns of growth were comparable between groups, with similarities observed between FGCS and NFGCS over time (ART ANOVA: $p = 0.14$, Cohen's $|d| = 0.41$, moderate effect). Increases were observed across academic, industry, healthcare, and government codes for both FGCS and NFGCS at the end of BME 1421 (**Appendix B, Table 3**). Moreover, 95% of FGCS and 88% of NFGCS were able to communicate that BME graduates can hold jobs in two or more career pathways following the course. The percentage of students indicating that they "don't know" of any jobs that BME graduates might hold decreased to 10% for FGCS and 12% for NFGCS.

Student knowledge of specific job titles and roles was also examined following completion of BME 1421. Prior to the course, FGCS and NFGCS demonstrated comparable knowledge of specific job titles and roles (**Figure 2**). Following participation in BME 1421, students demonstrated increased identification of job titles and roles, with both groups showing improvement over time. However, the magnitude of this increase differed between groups, where FGCS increased from 0.2 ± 0.1 to 1.4 ± 0.3 codes per student ($p = 0.0004$, Cohen's d = 1.24, large effect), while NFGCS increased from 0.2 ± 0.1 to 0.7 ± 0.1 codes per student ($p < 0.000$, Cohen's d = 0.51, moderate effect). Although the number of unique job titles or roles named by both groups increased over time, FGCS identified a greater number of job titles and roles than NFGCS at the end of the course ($p = 0.016$, Cohen's $|d| = 0.51$), indicating a moderate effect size. Research and development engineer and project/program manager remained the most named roles following the conclusion of the course; however, increases were also observed in the identification of manufacturing engineer, quality engineer, regulatory engineer, product development engineer,

clinical engineer, and sales engineer (**Appendix C, Table 4**). Additionally, the percentage of students indicating that they "don't know" any job titles or roles decreased to 20% for FGCS and 32% for NFGCS following BME 1421.

Skillsets and experiences were also coded following survey at the end BME 1421. Prior to the course, FGCS and NFGCS demonstrated comparable knowledge of career-relevant skillsets and experiences (**Figure 3**). Following participation in BME 1421, students demonstrated increased identification of skillsets and experiences (ART ANOVA: $p = 0.008$), indicating that students identified more skillsets and experiences at the end of the semester compared to the beginning. This pattern was observed across both FGCS and NFGCS. The number of codes that FGCS identified increased from 2.3 ± 0.5 to 3.6 ± 0.7 codes per student (Cohen's d = 0.58, moderate effect), while the number of codes that NFGCS identified increased from 2.4 ± 0.2 to 3.4 ± 0.2 codes per student (Cohen's d = 0.56, moderate effect). Patterns of growth were comparable between groups, with similarities observed between FGCS and NFGCS over time (ART ANOVA: $p = 0.76$, Cohen's $|d| = 0.10$, negligible effect). Increases were observed across technical skills, professional skills, knowledge, and experiences (**Appendix D, Table 5)**. Further, the percentage of students indicating that they "don't know" of any skillsets and experiences that undergraduate students should obtain or pursue prior to graduation decreased to 5% for FGCS and 6% for NFGCS following BME 1421.

Discussion

BME graduates pursue careers across industry, academia, healthcare, government, and related sectors; however, prior work has consistently shown that undergraduate students, particularly early in their academic trajectories, often hold narrow or incomplete perceptions of available career pathways and the professional skillsets required for success [7], [8], [9]. This study examined whether FGCS and NFGCS differ in their initial understanding of BME careers and whether participation in a first-year BME course supports development of career knowledge and professional awareness across these populations.

At the start of the semester, FGCS and NFGCS demonstrated largely similar levels of career knowledge, job title awareness, and understanding of desired professional skillsets. These results align with prior studies showing that undergraduate students across engineering disciplines tend to enter programs with limited understanding of engineering careers [7], [8]. To better understand these findings, we examined students' self-reported exposure to engineering and healthcare prior to entering the first-year BME course. Although overall levels of exposure were similar across groups, the pathways through which students gained that exposure differed. FGCS more often described exposure through high school coursework and, to a lesser extent, jobs or internships, whereas NFGCS more frequently described extracurricular activities and family connections. However, these patterns reflect tendencies within this sample rather than distinct or mutually exclusive group differences. Importantly, overall exposure levels were similar across groups, suggesting that comparable baseline career awareness may emerge from different reported access points and experiences prior to college. This reinforces that first-generation status in this study was not used as a proxy for discipline-specific experience but rather as a broader indicator of educational background.

Following participation in the first-year BME course, both FGCS and NFGCS demonstrated meaningful gains in awareness of BME career pathways, job titles and roles, and desired professional skillsets. These gains were associated with moderate to large effect sizes, indicating substantial improvements in students' ability to identify career pathways and relevant experiences. These findings are consistent with prior work showing that deliberate curricular exposure, such as targeted lectures, structured discussions, or short interventions, can significantly broaden students' understanding of engineering careers and technical and professional skills [7], [12]. Across most measures, FGCS and NFGCS demonstrated similar patterns of growth. However, in some areas (e.g., identification of specific job titles and roles), differences in the magnitude of change were observed, with FGCS demonstrating larger gains. From an equity perspective, these findings suggest that first-year, career-oriented BME courses may function as preventative rather than remedial interventions. Prior studies have shown that early professional identity development is positively associated with students' intentions to pursue STEM careers [13], while a growing body of work also highlights the importance of identity development for supporting persistence and belonging in STEM, particularly among underrepresented students [14]. By explicitly introducing career pathways, job roles, and valued skillsets early in the curriculum, such courses may reduce reliance on informal networks or prior exposure that can otherwise shape students' perceptions and opportunities. Rather than closing pre-existing gaps, the course examined here appears to support equitable professional awareness development across student populations.

Several limitations should be considered when interpreting these findings. The study was conducted at a single institution, and the smaller FGCS subgroup ($n = 21$) limits statistical power for detecting small between-group differences. Although moderate pre–post changes were detectable within groups, smaller effects, particularly for FGCS, may not have been observed. A sensitivity estimate ($\alpha = 0.05$, 80% power) indicates a minimum detectable standardized effect size of approximately 0.61 for FGCS and 0.28 for NFGCS ($n = 102$). That said, results should be interpreted with consideration of consistent patterns across measures and the magnitude of effects (Cohen's d), rather than reliance on individual p-values alone. Additionally, this work focused on the breadth of career knowledge rather than depth of understanding or alignment with students' intended career paths. Future work could more intentionally examine first-generation status within engineering to better understand how discipline-specific exposure and social capital shape students' early career awareness. Further research examining whether early gains in career awareness translate into differences in subsequent academic and co-curricular engagement, such as internships, research participation, or professional organization involvement, and whether these effects persist over time.

Conclusion

This study demonstrates that undergraduate understanding of BME career paths, industry job titles and roles, and desired skillsets and experiences is initially similar for BME FGCS and NFGCS. Further, implementation of first-year, major specific course that introduces the breadth of the BME discipline and support early professional exploration can substantially increase knowledge of career paths, industry job titles and roles, and desired skillsets/experiences by BME first years, and gains in knowledge are similarly for FGCS and NFGCS, which supports equitable professional awareness development across student populations.

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Appendix A: Survey Questions

1. Are you a first-generation college student? (Yes/No/Unsure/Prefer Not To Say)

2. Describe any prior experiences you have had working in or learning about engineering and/or the healthcare field.

3. What kinds of jobs do you think a graduate with a B.S. in Biomedical Engineering could hold after graduating? If you don't know of any, please type "don't know".

4. Scenario: You recently graduated from the University of Oklahoma with your B.S. in biomedical engineering and have begun to work at Company A. Company A is seeking to develop a medical device that designed to detect the electrical signals of a life-threatening condition within the brain and treat the condition. Company A employs a variety of biomedical engineers, each with specific job titles and roles, that will work on this endeavor.

   Describe the job titles and roles for the various biomedical engineers who would aid in the development and translation of this proposed medical device. If you do not know of any, please type "don't know".

5. What types of experiences and/or skills do you think an undergraduate should pursue/obtain during their undergraduate tenure to prepare for a career? If you don't know of any, please type "don't know".

Appendix B: Possible Career Path Codes Raw Counts.

Table 3. Possible Career Path Codes Raw Counts for FGCS and NFGCS in Week 1 and Week 15.

Codes		**Week 1**		**Week 15**	
		FGCS (N=21)	**NFGCS** (N=102)	**FGCS** (N=21)	**NFGCS** (N=102)
Academia	Education	2	8	2	13
	General	0	2	3	4
	Research	11	32	12	48
	Total	**13**	**42**	**18**	**65**
Industry	Bioinformatics	0	0	0	1
	Biomaterials	1	1	1	5
	Biomechanics	0	1	2	2
	Biotechnology	0	1	0	2
	Clinical Specialist	2	11	4	18
	Consulting	0	0	0	3
	General	3	19	6	35
	Imaging	0	4	1	2
	Manufacturing	1	1	2	2
	Medical Devices	7	23	8	30
	Operations	0	0	0	1
	Pharmaceuticals	0	10	2	7
	Project Management	0	1	0	5
	Quality	1	0	3	11
	Regulatory	0	0	2	3
	Research & Design	4	16	5	22
	Technical Sales	0	4	0	4
	Technical Support	0	7	4	9
	Total	**19**	**99**	**40**	**161**
Government	General	0	1	2	10
	Law	0	0	0	1
	Total	**0**	**1**	**2**	**13**
Healthcare	General	2	5	5	8
	Medicine	1	4	0	9
	Physicians Assistant	0	0	0	2
	Prosthetist	0	3	0	1
	Total	**3**	**12**	**5**	**20**
Grand Total		**35**	**154**	**63**	**259**

Appendix C. Possible Industry Job Titles and Roles Codes Raw Counts

Table 4. Possible Industry Job Titles and Roles Codes Raw Counts for FGCS and NFGCS in Week 1 and Week 15.

Industry Job Titles & Roles	**Week 1**		**Week 15**	
	FGCS (N=21)	**NFGCS** (N=102)	**FGCS** (N=21)	**NFGCS** (N=102)
Project/Program Manager	2	6	2	14
R&D Engineer	2	11	12	25
Manufacturing Engineer	0	0	1	7
Design Quality Engineer	0	1	6	10
Regulatory Affairs Specialist	0	0	2	8
Product Development	0	0	1	3
Clinical Field Engineer	0	0	3	6
Technical Sales Engineer	0	0	1	1
Procurement Engineer	0	0	0	2
Total	**4**	**18**	**28**	**76**

Appendix D. Possible Skillsets & Experiences Codes Raw Counts

Table 5. Possible Skillsets & Experiences Raw Codes Counts for FGCS and NFGCS in Week 1 and Week 15.

Codes		**Week 1**		**Week 15**	
		FGCS (N=21)	**NFGCS** (N=102)	**FGCS** (N=21)	**NFGCS** (N=102)
Technical Skills	Design Skills	1	5	5	12
	3D Printing	0	1	0	5
	Laboratory Skills	1	1	1	9
	Research Skills	2	4	5	6
	General	0	9	2	13
	Programming	2	9	3	18
	Circuits	1	1	1	4
	CAD	0	7	5	12
	Total	**7**	**37**	**22**	**79**
Professional Skills	Leadership	1	3	0	10
	Communication	3	11	1	10
	Time Management	0	0	1	2
	Organization	0	1	0	0
	Creativity	1	9	2	6
	Critical Thinking	1	4	2	5
	Problem Solving	1	5	4	7
	Teamwork	3	10	2	13
	Responsibility	0	1	0	0
	Project Management	0	2	0	1
	Flexibility	0	0	0	1
	Motivation	0	1	0	1
	People Skills	0	3	0	6
	Total	**10**	**50**	**12**	**62**
Knowledge	Medical Field	0	6	1	5
	General BME	2	16	3	15
	Basic Math & Science	1	7	1	9
	Biomechanics	1	2	1	3
	Electrical Principles	0	1	1	3
	Tissue Engineering	0	0	0	1
	Biomaterials	0	4	0	2
	Bioinstrumentation	0	2	2	7
	Anatomy	2	6	0	2
	Neuroengineering	1	1	0	3
	Pharmaceutics	0	0	0	1
	Bioimaging	0	1	0	0
	Nanomedicine	0	0	1	1
	Bioinformatics	0	0	2	8
	Total	**7**	**46**	**12**	**60**

Experiences	Minor	0	2	0	2
	Clinical	2	10	6	17
	Internship	6	23	6	32
	Research	9	36	10	47
	Student Organizations	0	5	0	9
	Total	**17**	**76**	**22**	**106**
Grand Total		**41**	**209**	**68**	**307**