

Work-In-Progress: Connections – First-Year Design, Students, and Life Beyond Engineering

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Abstract

This Work In Progress paper describes an effort to support first-year engineering students by connecting them with other students and providing a space to discuss the relationship between their first-year design course and life beyond the course. The engineering design course allows students to work on a real-world project and exposes them to a broad range of ideas and skills that are important in engineering. Many of these – such as communication, planning, teamwork, prioritization, and dealing with failure – are also very relevant to life beyond engineering. “Connections” is an optional supplement to this required design course that engineering students take during their first semester.

A small group of students in the first-year design course meets weekly during the semester in a gathering informally named “Connections.” This group is facilitated by a faculty member but is largely driven by the students. Since students in the Connections group come from several different sections of the first-year design course, they are exposed to other students going through a similar experience but with important differences in their experiences. For example, members of Connections are generally not part of the same project group and are working on different projects. Most members of Connections belong to different sections of the first-year design course and have different instructors for the course. Discussions in the group cover a wide range of topics. Examples include project-specific updates and requests for help; sharing frustrations and joys about the course and the overall first-year experience; questions about registering for classes, selecting a major, and interacting with faculty members; and broader updates and discussions on life in general. The facilitator typically suggests a possible theme or topic for each weekly discussion (often related to something going on in the first-year design course at that time), but this is only a suggested starting point and the discussion often moves to other topics.

Connections is now in its second year. Participants have particularly appreciated the opportunity for honest conversations about shared experiences. Future opportunities with the Connections group include (1) connecting students across multiple years and (2) more formally surveying participants about the benefits of participating in the group and potential areas for growth and improvement.

Introduction

First-year engineering students face many challenges. A variety of efforts have been made to provide support for students as they deal with difficult courseloads and adjustments to college. Institutions have developed modifications to curricula [1]; innovative introductory courses [2],[3]; new advising strategies [4],[5]; peer-led support options [6]; and extracurricular activities [7],[8] that aim to engage first-year engineering students, connect them to resources and community available at the institution, and enable them to succeed in engineering programs. Some efforts are purely academic; others touch on students’ lives outside the classroom. Some focus on challenges specific to engineering students; others address challenges that are not

specifically connected to engineering. Some attempt to cross the boundaries that separate engineering from life beyond engineering, the classroom from life outside the classroom, and individual students from others around them who can serve as a support.

Engineering is very applicable to real life and the world around us. Within engineering education, more and more emphasis is being placed on applying classroom knowledge to real-world problems and real-world contexts [9],[10]. The effort described here seeks to combine many of the ideas mentioned above – connecting engineering design concepts to the lives of first-year engineering students, supporting these students by building community, and breaking down barriers between individual students and between the engineering classroom and life beyond engineering.

Project Context and Implementation

Duke University has a required first-year design course for engineering students. This one-semester course (EGR101) allows students to learn the engineering design process, develop technical skills, and apply this knowledge to solve real world problems along with a small team of other first-year engineering students. Areas of emphasis in the course include prototyping skills (examples include CAD, laser cutting, circuits, and woodworking), communication (written technical memos, oral presentations, and poster presentations), teamwork, and project planning. Students in the course work very closely with the members of their project group (generally 4 or 5 students per group) and typically have limited interaction with other members of the class. Roughly 350 students take the course in the Fall semester. These students are distributed among many sections (9 sections in Fall 2021 and 8 sections in Fall 2022). A typical section has 40 to 50 students and is co-taught by two instructors.

The “Connections” group was started during the Fall 2021 semester. The original motivation for the group was (1) to provide a space for students to think about and discuss how the broad range of ideas covered in EGR101 connects to life more broadly and (2) to allow students to get to know and meaningfully interact with other EGR101 students beyond just those in their project group. The group was envisioned to be a regular but informal gathering of a small group of students and a facilitator (one of the EGR101 instructors). In the early part of the semester, an email was sent out to all EGR101 students describing “Connections” and requesting a response if they were interested in participating in this voluntary program. Next, interested students were asked to indicate their availability for a 1-hour weekly meeting throughout the semester. Based on the availability of interested students and of the faculty member organizing the Connections group, a weekly meeting time was selected. In Fall 2021, the email was sent out in the 5th week of the semester and the group started meeting in the 6th week of the semester. In Fall 2022, the email was sent out in the 3rd week of the semester and the group started meeting in the 4th week of the semester.

In each semester, about 10 students provided their availability for a meeting time. Based on the number of students expressing interest, only one “Connections” group was formed each semester. No meeting times worked for all students, but meeting times were selected to work for most students. The Fall 2021 group ultimately had a core group of 6 “regular attenders” and the

Fall 2022 group ultimately had a core group of 7 “regular attenders.” (In each of the semesters, one or two additional students came to an early meeting or two but then stopped attending.)

During a typical week, the facilitator would send out a reminder email regarding that week’s meeting and include a suggested topic for discussion or idea to think about. The suggested topics/ideas were typically related to what was going on in the EGR101 course at the time or to something about the rhythm of the semester. Sometimes topics were selected based on suggestions from members of the group or ideas that had come up in previous group discussions. Examples of topics and how they were related to what was going on in the class or in the semester are given in Table 1. Topics were intentionally selected to have connections not only to the course but also to life more broadly beyond the course. This allowed for easy transitions from talking about the class to talking about life in general.

Table 1. Sample Topics for Discussion

Topic	Motivation from Class or the Semester
Priorities	Design criteria must be prioritized appropriately while evaluating potential design solutions
Strengths/background/past experiences in engineering	Students enter the course with a wide variety of levels of experience in/exposure to engineering
Majors, classes, and registration	This was discussed as we approached the time when students had to register for courses for the next semester
Teamwork	Team dynamics can raise challenges for some students/teams in the course
Challenges due to time constraints	Appropriate time management and project planning is often a challenge in completing the design project
Failure	The prototyping process is iterative and involves lots of failure
Testing and drawing meaningful, accurate conclusions	Prototypes are tested to determine if design criteria are met and if the solution is successful
Ending things well	This was discussed as we approached the end of the semester/course/design project
Reflection	Many times during the course/project, time is taken to reflect on what is working well and what can be improved

The weekly meetings typically lasted an hour. The meetings usually started with updates from the group members about how life was going and anything that they wanted to share. Many meetings started with each individual sharing a “high” from the previous week, a “low” from the previous week, and something that individual was looking forward to in the coming week. At some point in the meeting, the facilitator would typically transition the group to the discussion topic. However, the general structure of the meetings was quite informal and some weeks the discussion never turned to the suggested topic since the group members were having good discussions about other topics.

During the second iteration of the group (in Fall 2022), students who had participated in the first iteration of the group (in Fall 2021) were invited to attend some of the Connections meetings to share some of their experiences, insights, and advice. Ultimately, two meetings in Fall 2022 were structured as question-and-answer sessions with two different participants from the Fall 2021 group.

Results and Discussion

The 13 “regular attenders” from the first two iterations of the EGR101 Connections group were asked to complete a brief survey to provide feedback on their experiences as part of the group. The survey included a mix of free-response questions and questions using a Likert scale. The survey questions are provided in the Appendix. Eleven students submitted a response to the survey. The results for the questions using a Likert scale are shown in Table 2.

Table 2. Survey Results Regarding EGR101 Connections

Question	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
<i>EGR101 Connections helped me connect with other students.</i>	73% (8/11)	27% (3/11)	0% (0/11)	0% (0/11)	0% (0/11)
<i>EGR101 Connections helped me connect ideas from class with life beyond the class.</i>	82% (9/11)	18% (2/11)	0% (0/11)	0% (0/11)	0% (0/11)
<i>EGR101 Connections was a valuable and worthwhile experience.</i>	100% (11/11)	0% (0/11)	0% (0/11)	0% (0/11)	0% (0/11)
<i>I would recommend EGR101 Connections to future EGR101 students.</i>	100% (11/11)	0% (0/11)	0% (0/11)	0% (0/11)	0% (0/11)

The students who responded to the survey were unanimous in their positive feelings toward EGR101 Connections. All of the students either agreed or strongly agreed that Connections was helpful in connecting them with other students and in connecting ideas from the first-year design course with life beyond the course. All of the students strongly agreed that the Connections experience was valuable and worthwhile and that they would recommend it to future students.

The responses to the open-ended questions indicate that participants in Connections valued meeting and discussing with other students who were going through a similar experience (the

first-year design course and being first-year engineering students) but who could provide different perspectives. Many students also felt supported by the group. The following sample responses reflect sentiments found in many of the responses:

- *“I liked talking with people and getting to know other first-year engineers that were not in my class/section/group. I think it was a good place to talk about things we all related to/experienced, but it was interesting to hear everyone's unique ideas.”*
- *“The most valuable aspect of EGR101 Connections was the sense of community I formed with my fellow engineering students.”*
- *“For an hour a week, I was able to slow down and take a different perspective on my week. This helped me make decisions, especially with the helpful input from others.”*
- *“EGR101 Connections was key to helping me transition to life at Duke as an engineering student.”*

Conclusions and Future Steps

Overall, the Connections group has been a great success for the students who have participated in it. Moving forward, questions remain regarding scaling up of this effort. Only a small percentage of EGR101 students expressed interest in being a part of Connections. This is likely due to the fact that students at Duke University tend to be very busy with their classes and extracurricular activities and may simply not have time to commit to another weekly meeting. Should additional efforts be made to draw more students into this program or should it continue to be simply one of many options that is presented to students? If the number of students who participate in Connections increases substantially, this will raise questions about how to best deal with the role of the facilitator. As things stand now, there is no curriculum or formal structure for the group. Much of the value of the group simply comes from the relationships developed between the participants of the group and also the relationships developed between the participants and the facilitator. If multiple Connections groups were to meet in a given semester, attending all of these meetings may be time-prohibitive for a single facilitator. If additional facilitators (possibly other EGR101 instructors, teaching assistants, or former participants in Connections) participated in the various groups, how would that change the nature of the groups? Is a facilitator even necessary in the meetings? It is possible that a single facilitator could help find interested students and form multiple groups based on availability. From there, could the students essentially run the groups either by themselves or with some limited support from the facilitator? These are questions that cannot be answered based on the initial implementation of the program but can possibly be explored in the future.

Other potential future steps include investigations into which populations of students are interested in something like Connections as well as investigations into the effect of Connections on the academic experiences of participants (for example, retention in engineering, academic performance, etc). As more cohorts pass through Connections, the possibility exists for expanding interaction across years so that first-year students can gain more insights from other students who have moved beyond the first-year experience. This might look like inviting former

Connections participants to meetings (as was done in Fall 2022) or finding other ways for the former Connections participants to serve as resources to the first-year students (for example, possibly through a “buddy”/mentor pairing). Another possible future step is considering expanding the scope of Connections – as one Connections participant stated, *“I think that this group can eventually evolve into a leadership type seminar where students rely on their experiences in EGR101 to touch on different aspects of what it means to be an effective leader and group member in engineering courses and workplaces.”*

Connections appears to be a valuable means of supporting and enhancing the experience of at least some first-year engineering students. It requires essentially no resources (other than a meeting space) and thus similar efforts can be tried or adapted relatively easily. It also represents a unique way for students to meet together, discuss, share insights, and support each other since it is related to a course (unlike most extracurricular activities) but is not formally part of the course. The Connections model can be used as a starting point for other potential efforts for supporting first-year engineering students.

References

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[9] M. Cross, D. M. Feinauer, M. W. Prairie, and S. H. Frisbie, “Tackling Real-World Problems in First-Year Electrical Engineering Experiences” in *2019 FYEE Conference*, 2019.

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Appendix

Survey Questions

1. EGR101 Connections helped me connect with other students.
 - Strongly agree
 - Somewhat agree
 - Neither agree nor disagree
 - Somewhat disagree
 - Strongly disagree
2. EGR101 Connections helped me connect ideas from class with life beyond the class.
 - Strongly agree
 - Somewhat agree
 - Neither agree nor disagree
 - Somewhat disagree
 - Strongly disagree
3. EGR101 Connections was a valuable and worthwhile experience.
 - Strongly agree
 - Somewhat agree
 - Neither agree nor disagree
 - Somewhat disagree
 - Strongly disagree
4. I would recommend EGR101 Connections to future EGR101 students.
 - Strongly agree
 - Somewhat agree
 - Neither agree nor disagree
 - Somewhat disagree
 - Strongly disagree
5. What was the most valuable aspect of EGR101 Connections?
6. What suggestions do you have for future iterations of EGR101 Connections?
7. Please provide any additional comments here.