# BOARD # 326: BASE Camp at Mines: NSF BPE Track 4 Phase 1: Year 1

**Dr. Danni Lopez-Rogina, Colorado School of Mines**

Danni Lopez-Rogina has a Sociology PhD from the University of Colorado Boulder with additional certifications in College Teaching and Behavioral Statistics. They work as a Post-Doctoral Researcher at the Colorado School of Mines. They specialize in race/ethnic relations, immigration, and social inequality. Danni is interested in building programs and curriculum that focus on shifting the tone from shame and anxiety on what people did not know to a proactive desire to rebuild institutions better.

**Stacey Roland, Colorado School of Mines**

Stacey Roland is a program coordinator for the Colorado School of Mines. Her focus is building programs that address the issues of belonging and inclusion in STEM spaces and how to find solutions that work for all students. She holds a Bachelor of Fine Arts from the Metropolitan State University of Denver and has experience working in both industry and K-12, as well.

**Dr. Jessica Mary Smith, Colorado School of Mines**

Jessica M. Smith is Associate Professor in the Engineering, Design & Society Division at the Colorado School of Mines and Director of Humanitarian Engineering Graduate Programs. Her research and teaching bring anthropological perspectives to bear on quest

**Lakshmi Krishna, Colorado School of Mines**

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## Introduction

Engineering programs have a global reputation for teaching deep technical skills but falling short on leading students through the professional skills they need upon reaching the workforce [1-4]. Numerous studies have indicated that engineering students leave undergrad feeling under-prepared for the social skills they will require in their new job, and engineering employers report disappointment in the well-roundedness of their new hires, particularly in the realms of communication, leadership skills, teamwork, and adaptability to various social dynamics [5-7].

Through a National Science Foundation grant (NSF BPE Track 4 Phase 1), the Colorado School of Mines launched a program called BASE Camp as a creative approach to providing training centered on communication and collaboration focused professional-skills as well as self-management and interpersonal skills. The objective of this study and the associated program is to use a mentorship and education model to strengthen student self-confidence in the soft skills they will require once entering the workforce [8-10]. The more immediate goal is to create a stronger community within the university via student social skill growth, thereby creating a more cohesive working environment.

The three overarching research questions to gauge success of the program center on 1) interpersonal skill education's impact on student confidence, 2) communication and conflict management skills aiding in group-work and collaboration settings, and 3) a resulting increase in overall school satisfaction through the teaching of self-management skills. The program is structured into four pillars (Self-Management, Interpersonal, Communication, and Collaboration) students can move through to gain further knowledge and experience. In each tier, a student completes a total number of hours of education, self-reflection, and scenario-based training, plus certain tasks to gauge deeper comprehension and application of training materials. Assessment of program results are being conducted through multiple measures. These include 1) pre and post surveys corresponding to training topics, 2) professional-skill level surveys conducted upon entering and leaving the program 3) guided reflection journals on personal growth before gaining final program certification, and 4) focus groups to gain feedback on what needs to be adjusted.

Preliminary findings suggest that the pilot group (students in leadership positions), who have undergone the first module of training, enter with less social knowledge than their faculty mentors hoped. They know broad themes but do not feel confident in their deeper knowledge on any particular topic and have a desire to better understand more complex skills like conflict management. This finding promises a wealth of space to grow and adjust the BASE Camp program within not only the home university but also partnering small STEM institutions across the United States.

## Data Collection Methods

The specific research questions developed in order to gauge the success of the program are as follows:

RQ 1. Does learning interpersonal skills help Mines students feel more confident on campus? Off campus? In their job prospects?
RQ2. Does learning communication and conflict management skills aid Mines students in group-work and collaboration settings?
RQ3. Does learning self-management skills aid Mines students in their overall school satisfaction?

To address the complexity of these questions, a mixed-methods approach was employed with the pilot population in Fall 2024. Combining quantitative and qualitative research ensures the accurate capture of exploratory data. As with any new program development, certain aspects of the target population—such as how they process new information and make decisions—remain unknown. Differences across age groups/cohorts in thought processes, language, stressors, perceptions of time management, and pre-existing knowledge cannot be assumed. Therefore, the research structure incorporated a combination of survey data, reflection journals, and focus groups. The specific ways these methods were designed to safeguard students while still collecting meaningful information will be detailed in the related research paper being presented at ASEE 2025, by Lopez-Rogina et al. (2024), titled "Work in Progress: Challenging the Narrative of Accessible Training Being a Burden: Developing Training on Belonging in a STEM University".

## Outline of Program

The BASE Camp education program is structured into four pillars of training content, as stated previously. At every tier, students engage in an accumulated number of hours dedicated to lectures, podcasts, readings, or similar learning formats, coupled with reflective tasks such as journaling to assess deeper comprehension and meeting with mentors to further apply materials learned.

To further enhance a sense of community, students receive BASE Camp branded items—such as t-shirts, stickers, or caps—upon completing different portions of training, which also enhances the program's visibility on campus.

### *Timeline of Program*

In Fall 2024, a pilot training program and its associated study were launched at Colorado School of Mines, supported by NSF (National Science Foundation) BPE Track funding. Based on feedback gathered during Fall 2024, significant changes in training content were made to align with student needs moving forward. Additional tweaking is set to occur in Spring 2025 and will be reflected on the poster session in Summer 2025. With continued funding, the BASE Camp programming is planned to resume in the 2025-2026 academic year, accompanied by ongoing data collection to evaluate progress and success metrics.

### *Curriculum Plan*

The teaching and peer leadership objectives of the BASE Camp program emphasize comprehension, self-reflection, and practical application of knowledge. Detailed information

about the curriculum objectives and lesson plans is available upon request from the primary author, Dr. Lopez-Rogina.

Upon completion of the first round of training and data collection materials, certain aspects stood out as needing further attention. The following section will be split into the successes and concerns for the program moving forward, as determined by preliminary data collected.

*Successes*

1) The Pre and Post Surveys provided interesting insight into the current status of knowledge and opinions among the student leaders. The pre-survey indicated that student leaders had far less knowledge and confidence in their knowledge of social terms and concepts than their associated faculty and staff leaders believed. This provided not only a better baseline for adjusting to where students were at, but it also aided in re-adjusting content to match the student population being catered to. The content and curriculum developer comes from a background of working primarily with social science and pre-law students, so gauging the differences in pre-knowledge at an engineering focused school was essential. The post-survey provided a benchmark for knowledge growth surrounding terms. While there will potentially be a downgrade in how confident students rate themselves in their knowledge of terms in the higher levels of training due to overconfidence after the first round [11, 12], these markers still aid in understanding how students feel about overall comprehension and ability to apply what they have learned.
2) The Focus Group findings not only supported the thoughts/concerns we had about what needed to be adjusted moving forward, but students were also able to give us specific feedback on aspects they liked and did not like. Suggestions were made regarding what they would like to see, which we were able to take into account as we re-adjust for the adjusted program. Some example feedback/suggestions included, 1) providing critical thinking/reflection questions for students to be considering while learning, 2) encouraging students to take notes on themes they are not familiar with, 3) giving students vetted resources for specific topics so that they can share them when occasions arise in their leadership and social roles, and 4) helping students see the connection between their own engineering work and the people they will be working with.

*Concerns and Adjustments*

1) After collecting Belonging Assessment data with the pilot group of student peer leaders, it became clear that gauging the sense of belonging and engagement of students who are in leadership positions is not ideal. This ran the pattern of reflecting the experiences of those closer to the top of the social pyramid. Instead, the focus needs to shift to gauge belonging and confidence of students who are not in leadership roles, ideally those who are from different social circles.
2) Based on feedback from the training sessions conducted in Fall 2024, adjustments were made in order to better accommodate and engage with our particular student population. This includes splitting the format into three different styles: 1) in-person with a live chat option so that students can ask questions while the facilitator talks without accidentally socially isolating peers via awkward language (see associated paper about this issue), 2) a synchronous online training session with the chat option facilitated by the research expert in

order to answer questions and provide resources as the training occurs, and 3) a fully asynchronous training session broken into smaller videos that individuals can work through on their own time. Questions can be left by students to be answered by the research specialist. In addition to these changes, the breaking up of content into resources in many different formats will be an increased focus moving forward. Students express exhaustion from the lecture format and are more likely to enjoy engaging in alternative learning methods such as videos, podcasts, and non-academic articles.

## Discussion and Conclusion

The successes of this pilot program include understanding how to better approach this particular population of students and gaining a sense of where students sit on the scale of feeling a sense of belonging and self-confidence within their university and field. The shift between the pilot program in Fall 2024 and the actual program put into place in Spring 2025 lies in the realization that engineering students significantly need assistance in the reality that their professional skills are not meeting the desires of employers overall. For a single semester of labor, this is an excellent start that allows the program to adjust as needed and move forward with confidence.

Moving forward, some adjustments to the program are being made while still seeking to maintain the heart of the mission. The shift comes not only on the heels of a change in presidential administration, but also on the recognition that the students involved find it difficult to connect material about the social world to their own field of engineering. Students find jobs all over the world and in different fields, and preparing them for that is more likely to engage their interest as being worth investing time into amidst their stressful schedules. Particularly in the field of engineering, graduated students find work everywhere from the oil and gas industry in Houston and Qatar to civil engineering projects in Flint, Michigan and the Dominican Republic. We believe that framing teaching about the variety of people they will work with into professional-skill career preparation [13] will engage students further. Through this mechanism, we will still engage trained peer leaders to have mentorship groups for discussion, reflection, and support, but teaching all students communication and conflict resolution skills will hopefully reach a broader student population.

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