

WIP: Using Photoelicitation to Explore Coping Strategies of First-Generation and Low-SES Engineering students

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Work in Progress: Examining Coping Strategies of First-Generation and Low-Socioeconomic Status Engineering Students

Abstract:

This work-in-progress poster seeks to examine how first-generation and/or low-socioeconomic status (SES) undergraduate students navigate and cope with challenges they encounter in their engineering programs. The increasing influx of students who identify as either first-generation or low-SES, particularly within engineering, calls for educators and researchers alike to better understand how these students are acclimating, learning, and advancing in their higher education. Previous research that analyzes low-SES or first-generation engineering students focuses on evaluating conditions or interventions that improve graduation or retention rates. While these findings have been beneficial, few studies qualitatively explore student experiences or attributes that influence success in an engineering context. Learning more about the attitudes and skills used when facing the engineering curriculum and the unique hurdles it poses to them can prove valuable to the first-generation / low-SES student body. This study aims to counter a deficit and individual framing towards low-SES and first-generation engineering students by finding shared coping strategies these students use throughout their undergraduate education. These strategies may encompass attitudes, strengths, and solutions drawn from previously lived experiences that their peers may not have shared or had to learn on their own. The guiding research question to develop this understanding is: *What coping strategies do first-generation and low-SES engineering students employ to navigate the challenges of their undergraduate experience?* This paper will introduce the use of Stallman's Health Theory of Coping, methodology, and preliminary findings of a pilot study conducted with low-SES or first-generation engineering students (n=6) at a large, public, historically white university in the Southeastern United States . The analysis of the interview transcripts with this framework is a first step in understanding how first-generation and low-SES students are managing the challenges faced pursuing their degree in engineering. This work in progress poster discusses newly developed codes for coping in this context and the common themes found among students. By understanding how students are responding to obstacles in their education, we can better address how to support students throughout their journey into engineering.

Introduction

In recent years, the identities of engineering students have rapidly expanded to include people of many different backgrounds and social classes [1], [2]. Approximately 30% of U.S. undergraduates identify as first-generation and/or low-income, yet within science, technology, engineering, and mathematics (STEM) fields this proportion drops to roughly 20%, pointing to a persistent disparity in access and representation [18]. This expansion requires researchers to better understand the new, minoritized groups of the student body and find accurate ways to understand their experiences. For example, low-SES and first-generation students have been

studied extensively regarding academic performance, but there remains a need to explore their ways of managing the higher education environment [3], [4]. Understanding the ways students grapple with college can enable better ways to support their needs. Current educational standards lack consideration of these students' needs and focus on the aforementioned students' deficiencies and attempt to teach adherence to the norms in engineering education [5]. This deficit-oriented framing can cause a ripple of negative effects on the education of first-generation and low-SES students both in the classroom and their personal lives.

There is a gap in how first-generation and low-SES students can be supported holistically as they navigate challenges during their studies. Students from low-SES high schools are known to be less likely to enroll in engineering at the collegial level [1], while first-generation college students in engineering have been found to have decreased engagement compared to their non-first-generation counterparts in engineering higher education [6]. Much of the existing research comparatively evaluates first-generation and/or low-SES students to their peers, surveys students' experiences, or tracks trends in academic metrics [7]. Unfortunately, much of this work focuses on identifying barriers without meaningful exploration on how students navigate and support themselves. Not knowing how these students navigate their journey imposes overgeneralizations onto the student and the barriers they face [8]. This in turn can lead to a deficit framing, putting focus and blame on an individual student's inability to successfully navigate engineering rather than on the structure, supports, and system their degree program exists in [9], [10].

This exploratory study seeks to address this gap by examining how first-generation and low-SES students navigate their undergraduate program, the challenges they encounter, and what resources, if any, are used to persist. Thus, the guiding research question for this study is: *What coping strategies do first-generation and low-SES engineering students employ to navigate the challenges of their undergraduate experience?* In contrast to prior work that has primarily compared outcomes or surveyed reported barriers, this study contributes a strengths-based, qualitative account that centers the coping strategies students themselves develop and employ in engineering contexts.

Theoretical Framework

We leverage Stallman's Health Theory of Coping (HTC) to examine how first-generation and/or low-income students responded to challenges they encountered. HTC acknowledges that all coping reactions are adaptive and will initially reduce distress [11]. At the same time, some strategies may have increased adverse consequences. Some coping mechanisms can cause unintended and unwanted negative consequences (e.g., physical, psychological, social, etc.) whereas others may yield positive outcomes, whether intended or not (e.g., seeking professional help may unexpectedly strengthen peer or mentor support networks) [11], [12]. Stallman suggested that coping strategies exist on a continuum of healthy and unhealthy, depicted in Figure 1. Healthy coping strategies range from lower intensity (e.g., positive self-talk) to higher intensity (e.g., being receptive to help from professionals) whereas unhealthy coping strategies

range from lower harm (e.g., negative self-talk) to higher harm (e.g., help seeking initiated because of suicidal ideation) [11], [12].

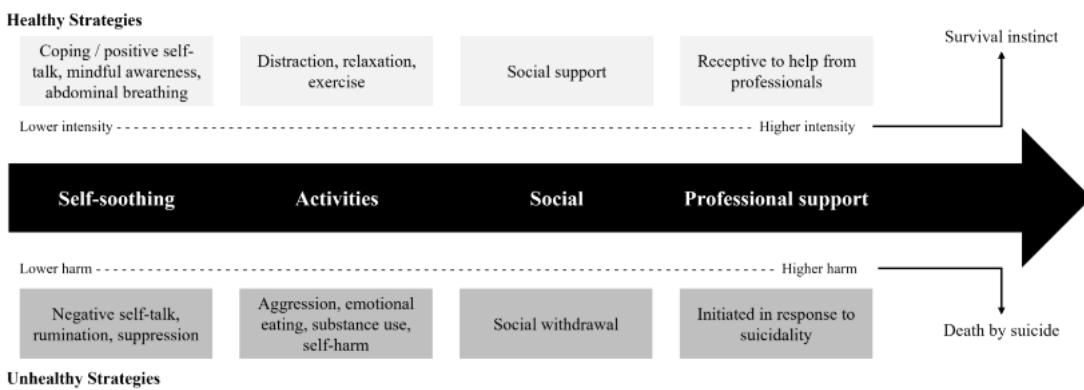


Figure 1. Continuum of coping mechanisms, modified from Stallman (2020).

We leveraged this continuum as the basis of our codebook for deductive thematic analysis, detailed in the methods section below.

Methods

Shared Definitions

We recognize that there are many ways that low-SES and/or first-generation students have been defined in literature [13], [14], [15]. The definitions that we used to define a *first-generation* or *low-SES* student are as follows. We classified a *first-generation* student as an individual who is the first in their family to achieve a particular educational milestone or status that is commonly regarded as significant; in the context of higher education, this typically refers to a student whose parent(s) did not earn a four-year college degree. We defined a *low-SES* individual or household as one whose financial resources are insufficient to meet basic needs and maintain a standard of living that supports overall well-being, which can include having limited income relative to local living costs, inadequate access to essential services such as healthcare, education, and housing, and experiencing financial instability. These definitions were provided to potential participants and have been used by the research team to provide consistency in dialogue and analysis for this study.

Data Collection

This study is part of a larger qualitative project exploring college students' coping and help-seeking behaviors as they navigate financial, academic, and social stressors. The study received Institutional Review Board (IRB) approval, with the University of Michigan serving as the single IRB (sIRB) institute of record (HUM00259512); all participants provided informed consent prior to participation. This manuscript focuses on six participants recruited from a large, public, historically white university in the Southeastern United States. Each participant first completed a

recruitment survey that inquired about their family background, academics and extracurricular involvement, and perceptions of belonging on campus. If interested, survey respondents were allowed to opt into the next stage of the study, which involved the submission of images that participants felt were representative of their experiences as an undergraduate student. The prompt given to participants in our image collection survey was as follows:

Reflect on five impactful experiences that you have had as an undergraduate engineering student here at the <institution> that relate to your identities as a first - generation and/or low - income student. Please try to capture experiences along the entire range of emotional experiences you've had (i.e., positive, negative, those in - between, and/or mixed experiences).

With this in mind, please select an image to represent each of the five experiences. These images can be ones you have taken, ones you take or create specifically for this project. Please submit each image with a 3 - 5 sentence caption explaining why the image was included.

Following image submission, participants took part in individual semi-structured, photo-elicitation interviews in which they reviewed and discussed their submitted images (protocol informed by [11]). The semi-structured interviews lasted approximately 60–90 minutes, starting with probes about the submitted images before expanding to students' broader experiences on campus. All interviews were audio recorded and transcribed verbatim. Identifying information was removed during the deidentification process to protect participant confidentiality.

Table 1 in Appendix B details the six participants included in the study. Most students were seniors (4), with one sophomore and one junior. Three engineering disciplines were included: computer systems (2), electrical (2), computer systems and electrical (1), and mechanical (1). Five students self-identified as first-generation college students and five students self-identified as low-SES. Of these, four students identified as both first-generation and low-SES. There were five race/ethnicities self-reported: Asian or Asian-American (2), Black or African-American/White (1), Latino (1), White (1), and White/Latino (1). Three participants self-identified as male and three were female. While no participants were international students, three shared that they were children of immigrants.

Data Analysis

We conducted deductive thematic analysis leveraging Stallman's HTC. The first and second author led the analysis and coded each transcript while the third through fifth authors supported this analysis in larger group discussions on the data analysis and findings. Each transcript was independently coded by at least two trained coders; both primary and secondary codes were assigned to relevant text segments.

We followed Braun and Clarke's four-step iterative coding process: (1) familiarization, (2) initial coding, (3) code reconciliation, and (4) thematic integration [17]. Initial codes were informed by a predetermined set of categories related to emotional regulation and coping, such as Self-Soothing, Activities, Social Support, Professional Support, and Want to Discuss. Each primary category incorporated both adaptive (“+”) and maladaptive (“-”) subcodes; for instance, Coping Self-Talk (+), Rumination (-), and Social Support (+) enabled coders to capture nuances within coping behaviors and emotional responses. Using the developed codebook, the first and second authors applied the structural and descriptive codes to text segments. Coding was non-restrictive, in that emerging findings or additional coping mechanisms not encompassed in existing codes could be added.

After initial coding, themes were adjusted and researchers iteratively discussed and resolved discrepancies in their interpretations of participants' responses to better represent the forms of coping mechanisms discussed in the transcripts. The team focused on thematic integration once the coding for all transcripts was completed. We worked to group related codes into higher-order themes reflecting participants' coping mechanisms, resource utilization, and emotional processes. This resulted in a finalized codebook.

Preliminary Findings and Discussion

The team has completed preliminary analysis of the data, with an emphasis on student navigation, to better inform further research on coping. In this section we first overview the finalized codebook, detailed in Table 2 in Appendix B. We then present two preliminary themes: *Perceptions of Coping* and *Barrier Navigation*.

Using Stallman's Health Theory of Coping (HTC) as an initial framework, we began with 25 coping mechanism codes and identified 4 additional emerging codes to capture aspects of student experiences not fully represented in the framework. Among the HTC codes, the most frequently occurring were Problem-Solving (82 excerpts), reflecting practical actions taken to address academic challenges; Negative Self-Talk (72), characterized by self-blame or doubt that intensified emotional strain; and Positive Self-Talk (51), which involved focusing on strengths, hope, or optimism to maintain motivation.

The most prevalent of the emerging codes was *Recognizing Constraints* with over 270 excerpts independently coded. *Recognizing Constraints* was added as a code for the instances in which a student discusses a need for resources that are not accessible or available to them, which in turn causes the use of other coping strategies. This code was applied in many contexts, for example if a student could not make office hours due to working or a limit on times a student can commute to campus due to financial restrictions. This strategy in itself can be a coping mechanism but also indicates what limitations students have that trigger other coping strategies.

Two codes that are seemingly similar but were deemed to represent different coping experiences are *Problem Solving* and *Navigating Barriers*. The definition of the former is focused on solvable tasks that students work through in higher education that represent a broader college experience, for example, “As long as my nose was in a book, they would say that I’d be successful, but that wasn’t enough you know?”. The *Navigating Barriers* is meant to encapsulate how low-SES and first-generation students address the constraints more common to their experience, such as, “I do not have any savings... I have to like, loan money to my father, who pays me back for our utilities at home.” These codes were the fifth and second most found codes, respectively. Together, these strategies were found to be cross-coded 40 times. This could indicate a need to differentiate these codes more or simply make them one code, due to the fact these were the fourth most cross-coded strategies.

A final thing to note from this codebook is the lack of some coping mechanisms; namely, *Rumination*, *Emotional-Eating*, *Self-Harm*, and *Substance Use*. It is important to acknowledge that these coping strategies are all negative and usually taboo subjects for interviewees to discuss. The lack of findings on these codes does not mean they do not exist, but represents that either our participant pool does not employ these strategies or did not feel comfortable discussing these topics.

Meta-Analysis: Perceptions of Coping

An emergent subject during these image-centered discussions was self-reflection from the first-generation and low-SES students on their own coping mechanisms. This theme highlights the fact that students evaluate or critique their coping approaches under both positive and negative circumstances even if they believe they have no other options. This self-evaluation was a notable finding because students could acknowledge external factors that impact them while still focusing primarily on their own coping mechanisms and what is within their control.

Throughout the interviews, reflection on an adverse experience caused students to share their coping strategies and often the conversation on their perceptions of coping followed. One instance of this was the interviewee, Maggie, giving herself positive reassurance based on her coping strategies of making sacrifices and recognizing constraints. Maggie shared, “I do wish I had more time to, like, work on assignments and stuff, but because I’m working, I really can’t. But I’m okay with that, because... I know that I’m not, like, into debt or anything, so that’s fine with me.” This perception of her coping mechanisms allowed her to rationalize her academic sacrifice but also demonstrates the culpability students feel in situations that are out of their control, such as financial burdens.

This link between constraint, sacrifice, and perception became a positive thought process for Maggie but also can transpire, unfortunately in many instances, to negative reasoning. Johnny harps on the topic of balancing work and school like Maggie but this triggers a guilt-focused conversation:

I feel bad because, like, like, I don't show up to class, you're thinking probably, like, I'm skipping class or something like that, but most of the time, I'm just tired. Because, usually I work from, like, 5 to 10.... which makes me sad, because I do want to be in the class, like, I want to learn! But just, like... they only have one time stop, one time that I can go to their classroom. It's always in the mornings.

This quote highlights the self-blame that can come from a lack of resources for employed students attempting to cope with restrictions on their time or finances. Students perceiving their coping strategies as inherently “good or bad” choices shows that there is a lack of consideration for these students' needs in higher education because they do not fit into the mold of their higher income engineering peers. *Perceptions of Coping* explores the ways students are self-evaluating and explains where it is students believe they are managing and struggling most.

Coping with Challenges: Navigating Barriers

Navigating Barriers emerged as a central theme, showing how low-income engineering students must continuously adapt to constraints that complicate basic academic participation. In Frank's experience, navigating barriers was an ongoing feature of college life. His choices demonstrate how monetary constraints shape what options are actually available: Frank detailed a late-night traffic stop that occurred while he was feeling especially ill, "He [police officer] asked if I wanted an ambulance... I told him no... I couldn't afford an ambulance." This instance illustrates how SES-related constraints compel students to prioritize monetary cost over personal safety, and this tells us about hidden risks embedded in daily life.

Frank's financial precariousness also determined the way he managed crises when they arose. After being given a \$700 ticket, he highlighted how such fines disproportionately affect low-income students: "If I get that \$700 ticket... then I would not be able to afford an entire month of rent." Although he had deliberately avoided loans, the situation forced him to reconsider: "As much as I hate loans... I'm going to have to pull this one out." Here, barrier navigation requires impossible trade-offs rather than any real choice; the student must take on long-term debt to maintain stability in the short term. Frank's situation is another example of how compounding constraints often force low-income students to confront a series of reinforcing barriers—financial, academic, or health-related. Across these examples, *Navigating Barriers* reflects a continuous labor that low-income engineering students perform simply to remain enrolled - work that consumes time, energy, and emotional capacity in ways that more financially secure peers rarely experience.

As a pilot study, these findings are not intended to be generalizable; the n=6 sample reflects a preliminary exploration meant to inform a larger ongoing study. The two themes presented here represent only an initial slice of the analysis. The remaining emerging codes—namely *Sacrifice* and *Recognizing Constraints*—along with additional challenges raised by participants beyond time and finances, will be elaborated in forthcoming work. The full codebook with code

frequencies and accompanying photo-elicitation imagery will likewise be reported in future publications.

Conclusion and Future Work

Identifying coping mechanisms and how they are utilized in different experiences provides insight into what students see as limiting external factors and what sacrifices they make to advance; this understanding can in turn inform methods to better cater to their unique needs. There are minimal studies regarding the Health Theory of Coping in the engineering education context, utilizing this framework allows for a better understanding of how students navigate their unique day-to-day obstacles in engineering. This study has found two preliminary findings: students *recognize constraints* which are imposed on them by either their class or race, and students are required to *make sacrifices* in time, opportunity, and well-being because no viable alternative exists.

Future work will dive deeper into the preliminary findings to find where exactly students are facing the greatest constraints and what can be done to better enable students' strengths. We intend to finish analyzing interview data next, specifically focusing on identifying how first-generation and/or low-SES students are navigating these challenges and what coping mechanisms are or are not regularly available to these students. Findings from this work can encourage institutions and educators to examine what low-SES and first-generation students do to cope and ultimately prevail through their unique higher education journeys.

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Appendix B

Table 1. Details on interview participants.

Pseudonym	Year in Program	Engineering Major	First-Gen*	Low-SES*	Race / Ethnicity	Sex / Gender	International Student
Frank	Junior	Electrical	Yes	No	White	Male	No
Gabe	Sophomore	Computer Systems	Yes	Yes	White / Latino	Male	No
Jenny	Senior	Mechanical	Yes	Yes	Asian or Asian-American	Female	No**
Johnny	Senior	Computer Systems & Electrical	Yes	Yes	Black or African-American / White	Male	No
Maggie	Senior	Computer Systems	Yes	Yes	Latino	Female	No**
Winter	Senior	Electrical	No	Yes	Asian or Asian-American	Female	No**

* = self-identified; ** = children of non-citizens / immigrants

Table 2. Finalized analytical codebook.

Category	Strategy	Common Definition
<i>Health Theory of Coping</i>		
Self-Soothing	Coping Self-Talk (+)	Encouraging inner dialogue that helps stabilize emotions during stress.
	Positive Self-Talk (+)	Focusing on strengths, hope, or optimism to stay motivated.
	Concrete Self-Talk (+)	Step-by-step internal sequencing to regain emotional control.
	Mindful Awareness (+)	Acknowledging feelings with calm acceptance.
	Negative Self-Talk (-)	Self-blame or doubt that worsens emotional strain.
	Rumination (-)	Replaying stressful events or mistakes repeatedly.
	Suppression (-)	Pushing down or ignoring feelings to keep functioning.
Activities	Distraction (+)	Healthy or neutral breaks to clear the mind.
	Distraction (-)	Avoidance or behaviors to delay responsibilities.
	Relaxation (+)	Restorative activities used to reset emotionally.
	Exercise (+)	Using movement to regulate mood or energy.
	Problem-Solving (+)	Practical actions taken to address solvable tasks or academic challenges
	Aggression (-)	Lashing out verbally or physically when feeling frustrated or pressured.
	Emotional Eating (-)	Using food for comfort instead of hunger.
	Substance Use (-)	Using substances to escape or dull stressful feelings.
Social Support	Self-Harm (-)	Hurting oneself physically as a way to manage emotional distress.
	Social Support (+): Family & Partner	Emotional/instrumental help from parents, siblings, or guardians.
	Social Support (+): Peer & Classmate	Support from classmates or academic peers.
	Social Support (+): Friend & Community	Non-academic or non-family friends as emotional supports.
	Social Support (+): Program or Student Group	Support from TRIO, cultural orgs, engineering orgs, ROTC, etc.
	Social Support (+): Other	Non-human or unconventional support sources (pets, Reddit, etc.).
Professional Support	Social Withdrawal (-)	Pulling away from people or isolating when stressed or overwhelmed.
	Accessed (+)	Using advisors, professors, counselors, or institutional resources.
	Unavailable/Inaccessible	Student wanted support but cost, logistics, or eligibility prevented access.
<i>Emerging Codes</i>		
Coping with Navigating Barriers	Navigating Barriers	Active steps to work around external constraints (financial, logistical, institutional) to keep functioning.
Coping with Trade-offs	Sacrifice	Coping by giving up opportunities, needs, or well-being because no viable alternatives exist.
Meta-Analysis	Perceptions of Coping Strategy	Student evaluates, justifies, critiques, or rationalizes their coping approach.
	Recognizing Constraints	Moments where students lack the resources, capacity, knowledge, time, or access needed to employ a coping strategy.