

WIP: Toward an Understanding of Psychological Safety in Graduate Engineering Research Groups – Preliminary Progress on Trust and Respect Constructs

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Abstract

The purpose of this work in progress paper is to present a preliminary codebook to understand how psychological safety manifests in graduate school research laboratories. Psychological safety is generally regarded as the belief that an individual working in a team can safely engage in interpersonal risks such as asking questions, seeking feedback, reporting mistakes, and proposing new ideas. Many researchers have explored psychological safety as a mediating factor of desired team-based outcomes such as creativity, effective communication, and performance. However, little research has explored how psychological safety manifests in graduate school, where research groups are often multicultural in nature and vary in the extent to which students work together on projects. As part of a larger, NSF-funded project, we have collected interviews investigating graduate engineering students' experiences and perspectives in research group environments. To determine how psychological safety is actualized in these settings, we have formed a preliminary qualitative codebook based on prominent psychological safety framings. This codebook consists of 8 constructs: Trust, Respect, Advisor Leader Behavior, Peer Leader Behavior, Peer Interactions, Group Characteristics and Work Design, and Positive Work Engagement. This codebook will be used to analyze 28 interviews with engineering PhD students, a subset of interviews from the larger project, to highlight how psychological safety constructs manifest in graduate research group settings. This work in progress paper details the development and preliminary findings of the Trust and Respect codes.

Motivation and literature review

Doctoral attrition, here meaning a premature departure from a doctoral program, remains a persistent problem in graduate education. Attrition reports show that only 64% of male students and 57% of female students complete their doctoral degree within a ten-year period [1]. In engineering, graduate students have shown a higher likelihood of experiencing depression and anxiety compared to other disciplines [2] which may contribute to these high attrition rates. As researchers have begun to investigate how graduate student experiences affect their decisions to persist or depart from their programs, a concerted effort has been made to pivot away from the "survival mindset" of graduate school. Instead, researchers are examining the conditions that lead to student thriving and net-positive experiences throughout their graduate programs. One approach to this effort investigates psychological safety, defined as the shared belief that it is safe to take interpersonal risks on a team [3]. Edmonson [3-5] asserts that in psychologically safe environments, others will respond positively when one asks questions, seeks feedback, reports mistakes, or proposes new ideas. In this framing, psychological safety is related to, but slightly strays from, similar concepts such as trust, efficacy, and intrinsic motivation [4]. Frazier et al. [6] adopt a slightly different view of what constitutes psychological safety. These authors include

psychological empowerment, work engagement, and trust as core components of psychological safety. These frameworks are applicable to team-based settings, where the team's level of psychological safety can affect the willingness to share knowledge [7] and leverage collective wisdom [8].

While psychological safety is primarily applied as a team construct, an individual's perception of the team can provide valuable knowledge of the team's climate. Individual perceptions of psychological safety have been studied in engineering design (e.g., [9, 10]) and engineering education spaces (e.g., [11, 12]) to impact desired outcomes. For example, Cole et al. [10] found that design teams who reported positive perceptions of team psychological safety produced higher quality ideas. An additional example from Beigpourian and Ohland [10] shows that low levels of psychological safety negatively influence knowledge sharing and perception of effectiveness. The emergence of psychological safety in engineering education has led to important findings in teaming literature. However, these findings are based on project-based teams such as class projects or design challenges. There is a lack of knowledge for co-working based teams such as graduate research groups.

The goal of this project is to understand what the spectrum of psychological safety looks like in graduate engineering research groups. By investigating the conditions and actions that influence and environments (i.e. research group) to become psychologically safe, we contribute to the growing body of literature that puts students' thriving first. Additionally, the findings from this study can be used to create evidence-based recommendations for building psychologically safe research groups. This work in progress paper details our starting approach to fulfill these research objectives.

Methods: Participant Recruitment and Data Collection

As part of a larger IRB approved NSF-funded study, a survey was distributed to graduate students through the graduate engineering departments of the top 50 engineering PhD-granting universities per ASEE 2023 Engineering by the Numbers report [13]. The recruitment survey consisted of several questions, including demographic information and Edmondson's psychological safety scale [3]. The psychological safety scale is comprised of seven items where participants rate their agreement on a 7-point Likert scale (Very Inaccurate to Very Accurate). Three items were reverse coded to match negative sentiments with a lower score. The survey included two sets of this scale, one set targets team interactions with the advisor present and the other targets team interactions without the advisor present.

From these survey responses, 61 participants were identified to interview for the larger study. The first three authors conducted semi-structured interviews that were designed to elicit responses regarding advisor relationships, peer relationships, research group and departmental culture, and demographic information. The interviews were conducted and recorded over Zoom, lasting approximately 60 minutes. All interviews were transcribed by a secure transcription service and cleaned for accuracy.

After all interviews were complete, participants were down-selected for the present study. The selection criterion for this study is based on the survey responses regarding perceptions of psychological safety. To encompass a range of psychologically safe and unsafe environments, participants were selected if their perceived psychological safety scores were at least two median absolute deviations from the median, which highlight extreme cases. A total of 28 participants meet this criterion.

A thematic analysis will be conducted with psychological safety as the conceptual orientation. Coding will follow an open and axial approach to allow for themes to emerge from the interview data. Specifically, coding will focus on scenarios where psychological safety is affected, including factors that support or inhibit its formation.

Progress to date: Code Development

A preliminary *a priori* codebook was formed based on common constructs amongst Edmondson's framework of psychological safety [3], Frazier et al.'s nomological network [6], and Newman et al.'s review of psychological safety [14]. This codebook includes Trust, Respect, Advisor Leader Behavior, Peer Leader Behavior, Peer Interactions, Group Characteristics and Work Design, and Positive Work Engagement parent codes. In this paper, we focus on the Trust and Respect codes. Here, Trust is defined as the intent to accept vulnerability based on the expectations of another individual, group, or institution's intentions and behavior [15]. Likewise, Respect is defined as the acknowledgement and value of one's identity, abilities, and status [16].

In Edmondson's Model of Antecedents and Consequences of Team Psychological Safety [4], Trust and Respect are paired as a joint organizational condition. This approach is supported by the assertion that if someone respects you, they are more willing to give the benefit of doubt. However, there are instances where Trust and Respect are not experienced harmoniously or in concert. For example, a student may respect their advisor's expertise but does not trust them to give constructive feedback. Acknowledging this potential misalignment, we have elected to de-couple Trust and Respect in this codebook and subsequent analyses.

This codebook also classifies Trust and Respect in either the cognitive or affective domain. Prior work has investigated cognitive-affective constructs as it pertains to trust (e.g., [17-19]) and respect (e.g., [20]) to understand human behavior and actions. While the cognitive domain has many broad definitions, in this codebook, the cognitive domain pertains to an individual/entity's competence and reliability. Likewise, the affective domain pertains to emotional bonds and interpersonal care. Lastly, we address the temporal nature of Trust and Respect. In the prior example, the student's perception of their advisor is based on their role as a knowledgeable member of the research community. The pattern of feedback that the student receives is based on specific actions and experiences. These instances reference different points in time where Trust and Respect are applicable; respect is assumed at the beginning of the interaction and trust is affected over time. To accommodate the different temporal references, we classify each instance of Trust and Respect as Assigned or Earned. The "Assigned" category indicates when Trust and Respect are granted

based on role, title, or general assumption, whereas the “Earned” category includes recognition for specific actions or achievements of an individual/entity.

In sum, Trust and Respect are parent codes with 2 sets of subcodes: Cognitive/Affective and Assigned/Earned. To illustrate, a single excerpt could be coded as “Trust: Cognitive-Earned” or “Respect: Affective-Assigned”. See Figure 1 for a visualization of the coding schema. Additionally, the codes were developed to have a neutral valence to include both positive and negative instances of Trust and Respect. Examples of the full coding schema are shown in Table 1.

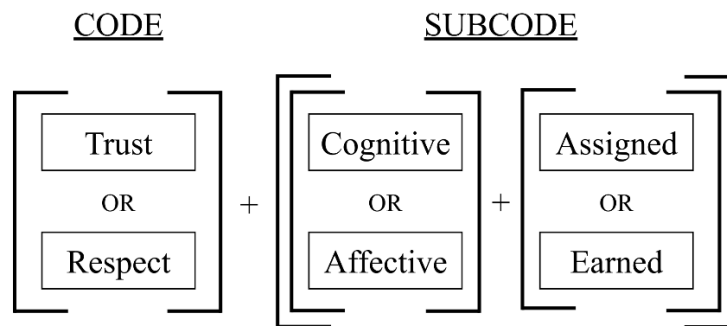


Figure 1: Visualization of Coding Schema

Table 1: Examples of Trust and Respect codes

Code	Example	Explanation
Trust: Cognitive- Earned	“...but speaking to some of the students who are maybe closer to defending, I think by the end [my advisor] is fairly hands-off with letting them figure out their own direction ”	The advisor’s management style reflects the evidence of late-career graduate students’ disciplinary expertise
Trust: Affective- Assigned	“I am not going to be able to sit here and not talk to anybody. I need to know [my labmates] and I need to like them. Or even if we don’t like each other, at least I want to believe that you are a good person and we work together well. ”	The research group members are assumed to be good people without any first-hand experiences or observations
Respect: Cognitive- Assigned	“I was really close to quitting just because I’m getting the idea that I’m being used as cheap labor and not treated like an actual researcher [by my advisor].”	The research skills are not being acknowledged by the advisor, despite the evidence that shows they have research knowledge
Respect: Affective- Earned	“I was a teaching assistant for the professor that would become my advisor. And he was a very kind person and he really cared about the well-being of his students. And I was like “ that is someone I want to work with ”	The students’ experiences as a teaching assistant culminate in admiration for the professor

Conclusions and future work

Both Trust and Respect are deemed to be necessary in working team environments (e.g. [10, 12, 21-24]). However, there are few accounts of what Trust and Respect look like, particularly in graduate research groups. Further, an exploration of what types of actions and contexts build or breakdown occurrences of Trust and Respect are necessary to fully understand what makes a psychologically safe environment. The introduction of our codebook is our first step towards this directive. In addition, we recommend that Trust and Respect be decoupled in future dialogue regarding psychological safety. Shallow machinations of these constructs may lead to an over-inflation of general measures of success and surviving a graduate program. Conversely, investigating Trust and Respect separately allows for more nuance that is truer to an individual's experiences and more holistically describes how one might thrive in their working environments. Future work regarding a holistic view of psychological safety will include the development of codes for the remaining constructs of psychological safety frameworks: Advisor Leader Behavior, Peer Leader Behavior, Peer Interactions, Group Characteristics and Work Design, and Positive Work Engagement. This complete codebook will be used to analyze the personal accounts of engineering graduate students to understand how psychological safety manifests in graduate research groups.

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