WIP: Adaptation of The Life Stressor Checklist to Study Racialized Stress Among Black and Latiné Undergraduate Engineering Students

Mr. Mark Okoth Onyango, University of Cincinnati

Mark Onyango is an Engineering Education doctoral student at The University of Cincinnati. He earned his master's degree in information and communication engineering from Harbin Institute of Technology's School of Electronics and Information Engineering in Harbin, China and holds a Bachelor of Education (Technical Education-Electrical) from Moi University in Eldoret, Kenya. With work experience spanning engineering industry and teaching in technical and vocational training institutions, my research centers on engineering workforce development among underrepresented groups with a focus on efforts to advance solutions on broadening participation in engineering spaces in college.

Elahe Vahidi, University of Cincinnati
Kaitlyn Anne Thomas, University of Nevada, Reno

Ms. Thomas is a doctoral student at University of Nevada, Reno in Engineering Education. Her background is in structural engineering. She received her bachelor's and master's degrees in civil engineering from Southern Methodist University. Her research focus is in epistemology and epistemic injustice in engineering.

Dr. Kelly J Cross, Georgia Institute of Technology

Dr. Cross is currently an Assistant Professor in the Biomedical Engineering Department at Georgia Tech.

Dr. Adam Kirn, University of Nevada, Reno

Adam Kirn is an Associate Professor of Engineering Education at the University of Nevada, Reno.

Dr. Whitney Gaskins, University of Cincinnati

Dr. Gaskins is an Associate Dean in the University of Cincinnati College of Engineering and Applied Science. Whitney earned her Bachelor of Science in Biomedical Engineering, her Masters of Business Administration in Quantitative Analysis and her Doctorate of Philosophy in Biomedical Engineering/Engineering Education. In 2009, she founded The Gaskins Foundation, a non-profit organization, who launched the STEMulates year-round K-12 program that introduces more students to math and science, that currently offers programming in five cities.

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Abstract

This methods Work in Progress (WIP) research paper presents the adaptation of the Life Stressor Checklist-Revised (LSC-R) to Black and Latiné (BL) undergraduate engineering students. The LSC-R questionnaire contains items that measure traumatic and other stressful life events, stressors that can arise from traditional engineering education. Specifically, for BL students, traditional engineering education has the propensity to result in stress, distress, and trauma. Furthermore, the marginalization of BL identities further exacerbates students' traumatic raced or racialized experiences. Adapting the LSC-R to the engineering context requires an examination of its validity. We modified the LSC-R and examined face and content validity using data collected from a sample of five BL undergraduate engineering students of different majors who took part in cognitive interviews carried out at a large R1 state university in the Midwestern United States. The results indicate good psychometric properties of the adapted version of the LSC-R, supporting its potential use in studying racialized stress among BL undergraduate engineering students.

Keywords: Validity, Stress, Engineering, Black and Latiné Students

Introduction

Undergraduate engineering students experience stressful life events before and during their collegiate years that impact their wellbeing. The nature and extent of the events can result in significant and sustained stress that has lasting deleterious effects. Jensen and Cross [1] found that undergraduate engineering students experience high levels of stress, anxiety, and depression, suggesting a potential mental health crisis in higher education institutions. Asghar et al. [2] established that stress in undergraduate engineering dampens students' motivation for learning due to heavy academic workload, while also indicating that further work is needed to determine the prevalence and impact of these experiences.

In engineering, negative academic experiences add another layer of stress for undergraduate students [1], [3]. Engineering academic stress — high academic workload and the need to pass an engineering course — has been shown to shape both professors' and students' engineering experiences [4]. This culture of stress has been normalized in engineering [1] to the detriment of the student's mental health [5]. Engineering academic stress is particularly problematic when paired with research showing that BL students experience unique stressors at the intersections of their identities in and out of engineering[6], [7], [8].

Despite the known impacts of stress broadly, and within the context of engineering for students from different identity groups, there is a limited body of literature assessing how these two sources of stress combine to shape BL engineering students' experiences. This work begins to address this gap by examining the validity of the LSC-R [9] to study racialized stress among BL undergraduate engineering students. The LSC-R is a broad-based yes/no response questionnaire with a 30-item scale used for assessing self-reported traumatic and other stressful life events. We

revised and adapted the LSC-R to understand these experiences in the context of engineering. This study was guided by the following research question:

Does the Life Stressor Checklist-Revised questionnaire retain the same psychometric properties when adapted for Black and Latiné undergraduate engineering students?

Specifically, we focused on (1) face validity, the participants' evaluation as to whether the adopted LSC-R items are relevant to the subject under investigation [10] and, (2) content validity, the participants' assessment of how their lived experiences are important and thus representative of undergraduate engineering students [11], [12].

Background

This research is part of a larger, mixed methods study on racialized trauma for BL engineering students. This paper draws from stress literature [13] and adopts the definition of stress by Folkman and Lazarus [14]. Stress refers to the circumstances or the relationship between the individual and the environment appraised in terms of relevance to wellbeing and in which personal resources are taxed or exceeded [14]. When increased stress levels are present, students are less likely to identify with engineering, feel like they belong, or persist [1], [3], [15], [16]. The stress inherent in the culture of engineering departments leads to attrition [13], [17], [18]. For example, grade disparities and attrition among first-year undergraduate students have been attributed to stress [19]. For traditionally excluded students, particularly BL students, attrition leads to the underrepresentation of BL individuals in the engineering workforce [20], [21], [22].

The LSC-R measures a range of experiences that induce significant stress for students (e.g., death, sexual assault) [23]. However, asking individuals about their lived experiences around stress and trauma can lead to non-completion of surveys and assessments [24]. To counter such occurrences, surveys like the LSC-R can be adapted to ensure reflection of context and support of participants. For example, Humphreys and colleagues [25] employed direct interviews with Colombian women whose feedback about the stressful experiences in their lives enabled adaptation of the LSC-R. Other successful validations of the LSC-R adapted to different contexts include psychiatric outpatients with anxiety or depressive disorders [23] and assessing prevalence of stressful life events among individuals with stimulant use disorders [26]. However, none of these studies have used the LSC-R in an engineering context.

To effectively deploy a modified instrument and achieve the same psychometric goal, there is need to ensure that the changes are clear and well-understood by the participants [27], [28], [29]. Using qualitative methods, Engel [11] investigated the content and face validity by exploring participants' understanding of the quality of life (QoL) instrument, while Connell [28] articulated the importance of content and face validity in instrument development. Using probing cognitive interviews enables bi-directional conversations between the interviewer and participant. This approach helps in centering the voices of students through their self-reported accounts of stressful life experiences and supporting the refinement of the LSC-R for BL engineering students.

Methods

Participants

A purposive sampling technique was used to recruit participants for this qualitative study to ensure that recruits fit the study criteria [30]. To be eligible, a student must be (1) enrolled in an undergraduate engineering program, (2) in the second or higher year of study because the study targeted students who have had time to experience the engineering culture, and (3) a member of the BL community. A recruitment email was circulated through the leadership of specific student associations. Ten students responded to the recruitment call, with only five meeting the criteria for the study. The participants were five undergraduate engineering students (Black = 2, Latiné = 3) of different majors at a large R1 state university in the Midwestern United States (Table 1). We chose BL students because of the significant underrepresentation of BL individuals in engineering [31].

Table 1: Participant demographics

Pseudonym	Major	Year of Study	Racial/Ethnic group
Marissa	Mechanical Engineering Technology	Sophomore	Black
Frank	Electrical Engineering	Sophomore	Black
Cohen	Environmental Engineering	Senior	Latiné
May	Chemical Engineering	Sophomore	Latiné
Kenny	Mechanical Engineering	Senior	Latiné

Data Collection and Analysis

Data was collected using the cognitive interview method [32], [33]. Interviews were conducted in-person or virtually via videoconferencing software, contingent on the participant's availability [34], [35]. The research team undertook a series of revisions of the LSC-R survey questionnaire to capture the lived experiences of the respondents. The final questionnaire included all 30 questions and one five-point Likert scale follow-up question, "How much has this affected your life in the past year?" in section e of the LSC-R. Two open-ended probing questions adapted from Peterson et al. [36] were added at the end of the survey. They included (1) How completely do your answers represent your experiences as an undergraduate engineering student? (2) Do all the items combined adequately represent your experience with what you understand to be the topic of the survey? Question 1 investigated if the participants understood the concept of the questions about the subject under investigation, while question 2 sought to establish whether such responses are representative of other undergraduate engineering students. The aim of this process was to ensure that the adapted instrument has psychometric properties comparable to the original instrument. A probing approach was taken due to the high cognitive load of the topics within the survey. A note-taking form supported information gathering [37]. Utilizing MaxQDA coding software, we thematically analyzed participant responses to identify the items that were relevant to the study [12]. We qualitatively assessed content and face validity [11], [28] by exploring the participant responses to the LSC-R items and the two open-ended questions added to the questionnaire [38].

Quality

The five study participants were contacted and the findings shared with them, as a means of data validation [39]. Three reported back to the researchers with feedback confirming accurate reporting. Additionally, results and interpretations were iteratively checked through regular discussions with the research team about participants' open-ended responses [40].

Limitations

The study is at a preliminary stage with a small sample size. A future large-scale study will explore quantitative analysis of validity, including a reliability test using Cronbach's alpha to assess the internal consistency of the scale [41], [42]. The results being collected from one institution in the United States have the potential to miss other events and stressors tied to specific regions (e.g., hurricanes, wildfires, deportation).

Results and Discussion

Content Validity

Content validity ensures that an instrument's content accurately and comprehensively reflects what it aims to measure. Based on the information from the five participants, we can infer that the reported stressful events are broadly applicable to all students. Two themes emerged from the participants' responses regarding items that were important and resonated with their lived experiences: (1) Financial insecurity and (2) Communication breakdown. The first theme stemmed from item 9 and relates to the stress that develops from the financial challenges experienced by participants. May said that the lack of pre-college free lunch programs made life difficult because of the inability to afford meals, asserting:

> My parents struggled, and I some kind of went through a lot 'cause there was no lunch at school…but here I am, pursuing engineering.

May describes the stress caused by the inability to afford food prior to college. Although she was able to receive a scholarship which helps cover the cost of meal plans in college, the threat of food insecurity remains. The financial problem was confirmed by Cohen, thus:

> My brother had sugar disease. This meant I had to skip school to follow up on his sugar level. Taking care of him involved finances, which was a problem at that time…How do you concentrate in school with all that?

Furthermore, the data indicates that communication breakdown between participants and peers, and participants and faculty contributed to stress. Cohen could not attend school regularly while taking care of his brother's sugar disease. This limited his participation and feedback with team members in a team project in an engineering course. While Cohen's stressful event affected his relationship with peers, Marissa attributed distress to faculty communication and understanding and stated:

> I had some difficulties after my car crash and sexual assault to my friend outside campus. This forced me to miss classes, but somehow some teachers couldn't understand.

The financial insecurity is evidence of capital-induced stressors, while the disconnect between students and their peers and faculty exhibits the engineering stress culture. Collectively, these events keep undergraduate engineering students out of campus.

Face Validity

Correspondingly, the participants' evaluation as to whether the adopted LSC-R items are relevant to the subject under investigation revealed two themes, (1) Relevance and comprehensiveness, and (2) Question Ambiguity. Considering how completely the answers represented their undergraduate engineering experiences, all the participants except Frank agreed that the items are relevant to the topic of the study. Frank reported:

> They are broad-based hence I cannot really explain how some of them can impact my engineering curriculum.

Among participants who agreed, Kenny mentioned that the questions provide hints for the behavior of students in the engineering school, adding:

> I cannot think of other major areas because the questions you have asked me captured most of my experiences.

However, instances of repetition of questions were noted because they said questions seemed similar. In particular, "Have you ever witnessed a serious accident (for example, a bad car wreck or work-related accident)?" (item 2, witnessed serious accident) and "Have you ever been in a serious accident or accident-related injury (for example, a bad car wreck or an on-the-job accident)?" (item 3, experienced serious accident) caused confusion among participants who thought that the questions were similar.

Regarding question ambiguity, items 9 and 16 elicited multiple responses, with participants expressing an inability to decipher the specific subject under investigation. For instance, the examples provided in item 9, "Have you ever been financially insecure (for example, not enough money for food or place to live)?" resulted in a conversation about how food affordability and family displacement or homelessness are independent. Similarly, item 16 asked whether a participant has ever been responsible for taking care of someone with physical or mental disability, despite the distinct impairment. Such question formatting leaves room for multiple interpretations, thus altering the originally intended psychometric property.

Across the participants' responses, we found that most items were easily understood and interpreted by our five participants. Results indicated that the LSC-R adapts to engineering students' experiences. Additionally, this work revealed that items such as the ambiguous question mentioned will need further revisions. Future work will continue to test the reliability and validity of the LSC-R in engineering through additional interviews at other sides and piloting of the survey to a larger population.

Conclusion

The findings show that the adapted LSC-R questionnaire is acceptable and valid for and applicable to BL undergraduate engineering students. Therefore, the LSC-R instrument will help

guide further research on how racialized trauma embedded in prevailing engineering educational practices may aggravate stress, distress, and traumatic experiences that inordinately impact BL students.

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