"At the Bottom of the Food Chain": Constructing Academic Identity in Engineering Education as International Graduate Students

Cristian Eduardo Vargas Ordonez

Cristián (Cris) Vargas-Ordóñez (he/his/él) is a Colombian third-year PhD student in Engineering Education at Purdue University. Raised around the life of photography and as an amateur contact improv dancer and yoga teacher, he is interested in integrating the arts and engineering in educational settings to promote and protect universally recognized human rights and fundamental freedoms. His research with his advisor, Dr. Morgan Hynes, includes literature reviews, calls for action, and qualitative studies understanding how to make this kind of integration from a perspective of critical theories. As a result, he has developed and taught curricular initiatives such as Purdue's honors course Compassionate Engineering and K-12 theater and engineering activities related to bullying prevention. As an international student in the US, Cristián is convinced that it is needed to bring a voice to this frequently overlooked population. He was director and producer of the podcast "We, the Aliens" and is currently one of the receivers of the CILMAR seed grant. His goal is to advocate for international students while developing and improving his research. As a chemical engineer, he has worked in various sectors and private and public companies. He also has belonged to Colombian educational formal and informal settings as a pedagogy consultant at the Planetarium of Bogotá: Innovation, Science, and Technology instructor and consultant at the science and technology museum Maloka, and secondary school teacher in Chemistry. As part of his research in Spanish, he has explored Colombian chemical engineers' social representations about science and technology, their conceptions and attitudes about chemical engineering, and their identity as chemical engineers. Cristián is a Master in Education from the University of Los Andes in Colombia, a Master in Science, Technology, and Society from the National University of Quilmes in Argentina, and a B.S. in Chemical Engineering from the University of America in Colombia.

Siqing Wei

Siqing Wei received B.S. and M.S. in Electrical Engineering from Purdue University. He is currently pursuing a Ph.D. degree in Engineering Education program at Purdue University. After years of experience serving as a peer teacher and a graduate teaching assistant in first-year engineering courses, he has been a research assistant at CATME research group studying multicultural team dynamics and outcomes. The research interests span how cultural diversity impacts teamwork and how to help students improve intercultural competency and teamwork competency by interventions, counseling, pedagogy, and tool selection (such as how to use CATME Team-Maker to form inclusive and diversified teams) to promote DEI. In addition, he also works on many research-to-practice projects to enhance educational technology usage in engineering classrooms and educational research by various methods, such as natural language processing. In addition, he is also interested in the learning experiences of international students. Siqing also works as the technical development and support manager at the CATME research group.

Tiantian Li

Tiantian Li (Olivia) is a PhD student in Engineering Education at Purdue University. She is a Purdue graduate with a Bachelor of Science degree in Biological Engineering, with a concentration in Pharmaceutical Processing Engineering. She has completed Purdue's Certificate of Systems Engineering and Quantitative Research, Assessment, and Evaluation in Education Certificate. Her research interest is in the assessment of systems thinking skills and systems awareness. She is also interested in studying international scholars' experience within engineering.

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Introduction

For the U.S., attracting and recruiting talents, especially international students, benefits the personal growth of the students themselves and the nation to keep up the excellence and overall leadership. However, international students, especially graduate students, in the United States might fall into several exclusive issues and dilemmas that negatively influence the construction of their academic identity [1]. Firstly, changing policies on visas and immigration have negatively and systematically affected international graduate students arriving on U.S. campuses. This uncertainty due to changes in the political climate and global events unproportionally impacts students from countries such as Iran and China [2]–[4]. Secondly, an international student visa has a limited duration and associated criteria to ensure legitimate status. They tend to force themselves to develop and maintain a compliant relationship with their institutions, the staff, and faculty (who usually sponsor the students) to avoid conflicts, making them vulnerable. This vulnerability might make international students hesitant to report suspected research misconduct, academic exploitation, or harassment and could significantly impair their career development, wellbeing, and psychological safety [5]. Thirdly, international graduate students have more systematic limitations in access to funding sources and employment opportunities. In addition, international students in higher education inevitably encounter cultural differences and shocks, which might hinder the positive construction of their academic identities and learning experiences [6], [7]. Studying and researching in a foreign institution could challenge the values, feelings, languages, and behaviors oriented and sustained by the different cultural backgrounds of international students, including language deficiency, lack of social and cultural knowledge, potential mismatch of communication between international students and others, and unfamiliar learning styles [7].

Although international engineering graduate students contribute much to boosting the U.S. economy and keeping it competitive, they are understudied in their circumstances. Scholars focusing on Engineering Education Research (EER) are part of the ecosystem to educate engineering students and prepare them for the workforce. Within the engineering education research (EER) literature, few were identified to study the international students [8]–[10], and few relate to the graduate students' learning experiences [11]–[13]. To our best knowledge, the only work known to focus on the intersection of international and graduate students is from Lee on belongingness [14], [15]. No particular work focuses on engineering education students who need to be recognized and studied. Klassen and Case argued that U.S. scholars tend to converge to consider EER as a singular interdisciplinary field, while non-U.S. scholar treats EER more like a blended region integrating both engineering practice and teaching [16]. Therefore, international graduates who study EER in the U.S. might embed inherent conflicts about who they are as engineering education scholars, namely how they define their academic identity. Thus, this work-in-progress paper seeks to answer the research question: how do international students construct their academic identities in a graduate program in Engineering Education?

Theoretical Framework: Funds of Identity

In this work, we adopt the funds of identity theory as a framework for research design and data interpretation. Funds of Identity theory centers on identity as a social constructivism perspective

while viewing identity as a form of capital [17], [18]. Thus, identity is conceptualized using Vygotsky's point of view and as a "lived experience." Instead of the experience itself, Vygotsky argues that it is an individual's consciousness and subjective interpretation of the lived experiences that influence their self-perception and, thus, their identity [17], [19]. Additionally, Vygotsky's idea of the zone of proximal development indicates that the formation of one's identity is dependent on their social interactions with others and can be influenced by social, cultural, and historical factors [20]. As a result, a person's identity becomes a fluid, dynamic, and complex concept. In other words, to construct and examine one's identity requires a comprehensive look into the person's lived experience (**social constructivism**) and treating their lived experiences as **social capital**. This notion of treating identity as a form of capital originated from social capital theories and is closely related to the funds of knowledge approach [20]–[22]. The funds of knowledge approach was initially used to study how U.S. Mexican students construct their knowledge using their households' unique economic and social resources [23]. This approach allowed educators to update their pedagogies and curricula and adopt a more inclusive way of teaching in K-12 classrooms.

Similarly, the Funds of Identity theory examines resources during the identity construction process and can be used as a tool to study specific populations. It is worth noting that even though Funds of Identity theory focuses on resources, the lack of resources and funds of identity construction is also vital and valuable to explore in our opinions. By establishing the resources or lack of resources for identity construction, researchers can holistically examine identity from the perspective of equity and power relations, thus, approaching identity with a critical and individualized mindset [24], [25]. Esteban-Guitart and Moll asserted identity to be "historically accumulated, culturally developed, and socially distributed" [17], the definitions of which were operationalized in the results section below. Therefore, as international students generally have complex cultural backgrounds and forms of capital, we utilize the Funds of Identity theory to examine their academic identities and understand what they consider valuable and the most-needed forms of capital to support their academic and career pursuits.

Methodology
We conducted a phenomenological study [20], inquiring about the essence of the participants' academic identity through one round of in-depth semi-structured interviews [21]. Five international graduate students from the engineering education program in the same institution answered the callout and were interviewed via Zoom. They responded to questions concerning their current resources and struggles as graduate students from different countries besides the United States. To reach the essence of the participants' experience, we asked for a drawing before the interview, similar to the techniques presented by Esteban-Guitart and Moll [12], showing who they are and the resources they have as international graduate students in engineering education in the U.S. at the moment of the interview. One of the five participants decided to avoid the drawing and start directly with the interview. For those who made the drawings, the interview began with explaining their drawings, accompanied by follow-up questions that dove into some resonant aspects. Besides explaining the drawing, we asked the participants about how they got into the engineering education program, what motivated them to continue the academic pathway, who has helped them along the journey, and how their relationships with their peers and advisors are. During these interviews, responses related to the challenges and barriers to pursuing a smooth academic path in engineering education emerged.

We also asked follow-up questions for more detail, especially concerning institutional issues, personal and professional relationships, and laws and regulations.

The transcription started during the interview, using Zoom's live transcription option, followed by a detailed manual review of the data. We used an interpretive data analysis model [22], recording our first impressions in memos and annotations and later studying them for interpretations. The procedure consisted of, firstly, reading the transcriptions individually and annotating. Secondly, we collected these annotations in a matrix to categorize them as possible future research questions, opinions, and emergent topics. We classified and defined only the emergent topics graphically using Miro [26], identifying three possible main milestones: *before the Ph.D.*, *transition to the Ph.D.*, and *current Ph.D. life*. It was remarkable that topics that emerged first focused on the absence of resources, which did not necessarily mean it was the only information collected during the interviews. Then we linked the milestones to the three attributes of funds of identity. Historically accumulated experiences link to before and transition milestones. Culturally developed identities and socially distributed resources correspond to participants' current Ph. D. life so far. We discussed, created, and bracketed our positionality as researchers in parallel to the analysis process described in the next section. We chose not to disclose any identifiable information about our participants in the writing phase to protect their anonymity. However, our participants vary across gender, race/ethnicity, nationality, seniority in the graduate program, different levels of English proficiency, and paired with different primary advisors. Finally, although the interpretive model includes a second round of analysis, we considered that a second round of interviews is required before advancing to the final codes. In that sense, this paper presents the first salient interpretations, including some potential themes and future questions.

Positionality Statement
The research team consists of three middle-to-senior level international graduate students in the studied program. Two members from Asia self-identified as female and male, respectively, and one from Latin America self-identified as male. All of our native languages are not English. We have pretty different educational backgrounds in engineering when starting the graduate school in engineering education: one researcher entered the Ph.D. program directly after obtaining her bachelor's degree; one joined the department as a dual program while pursuing a master's degree; the other one spent several years in industry before entering the department. Our research interests and topics are different, but we share the commonality of international identity on the research site. We are working with advisors at different stages in their careers. Lastly, we also had different levels of engagement and involvement with the student associations at both departmental and institutional levels, which enriches the funds of resources of the team to have a broad perspective of the research topic and question. Therefore, our backgrounds inevitably influence how we understand, interpret, and transmit our participant's experiences, beliefs, and opinions and how we construct the meanings behind them. With the possibility of solid empathy, resonance, and maybe disagreement with our participants' narratives, the research team aimed to analyze the data and present the participants' lived stories transparent and undistorted.

Preliminary results
Preliminary results are organized on the three attributes based on the funds of identity theory: historically accumulated experiences, culturally developed identities, and socially distributed resources. The subthemes of the three attributes will be introduced based on our interpretive analysis. Broadly, the historically accumulated experiences build the foundation for our participants to access, survive, and thrive in their program. The culturally developed identities and socially distributed resources capture our participants' identities' intra- and inter-personal aspects.

In this work, we conceptualize the ***historically accumulated experiences*** to be participants' past experiences before coming to the studied program and their experience of transition in the program. Specifically, we identify two subthemes: the diverse academic pathways and the barriers, supports, and adjustments, either expected or unexpected, that participants are currently facing. For the academic pathways, our participants discussed their educational and family backgrounds, which motivate them to pursue and transit into their Ph.D. degrees. People choose to study engineering education for various reasons, ranging from personal growth to better career development and empowerment. For example, Richard indicated that "*I have to do that [Ph.D.] for my next steps in my career.*" However, not all of the participants have strong interests in EER, and studying engineering education is merely serving as a steppingstone – two of them indicated that around the period of accepting the admission offer, they didn't have other options available. Regarding the second subtheme, many barriers showed up after participants enrolled in the program, including lack of belongingness, daily life adjustment, emotional burdens for recognizing their minoritized status, and living with stereotypes. The transition of living in a foreign country for studying could induce many emotional burdens for international students and lead to a lack of belongingness. Jerry said, "*I, you know, this is the United States. It's not where I'm from.*" Furthermore, dealing with unspoken social norms and stereotypes intensifies the lack of belongingness. When asked why Charlie felt they had less agency to speak up, they expressed the hardship of dealing with social norms. *"The first thing is about this language barrier that I talked about, but I'm not saying just in terms of English… but more like the language… the way you speak… [in terms of] some keywords."*

Culturally developed identities refer to the identity attributes that involve the symbols, meanings, perceptions, values, and behaviors that construct the current identity of the participants. Two subthemes are centered on: "What does it mean to be an international student?" and "What does it mean to be an engineering educator?" The first one involves what the participants perceive as important symbols and behaviors that shape their identity as international students in the U.S. For example, all the participants' perceptions of international students' identity were constrained by their legal status (visa and citizenship); additionally, they also observed their ways of doing and being compared to those of Americans, which informs the construction of the participants' identities. Participants like Angela, Charlie, and Jerry emphasized some cultural differences that impacted their adaption to the American lifestyle. Differences include the kind of food available and where to find it, the perception of cheap and expensive, how to deal with bureaucratic procedures, how to improve their English in the case of non-native English speakers, and how to make friends. For Angela, these cultural differences made her spend more time and energy, which resulted in less time to focus on her Ph.D. duties

and more on surviving. Furthermore, the international student identity is also shaped by discriminatory attitudes related to race. Angela explained: "*I was just new here. I still didn't realize about these kinds of things. I realized that I had a seat right next to me [on the bus]. And I realized that everybody was sitting everywhere else, and people were even standing. And they won't sit next to me. Yeah, so I was like, oh my god! What? This is crazy.*" This experience made them consider race as a new concept that shapes their identities as international students in the U.S. As a result, it gave the sense that every international student is "*like at the bottom of the food chain.*"

The second subtheme focuses on how the participants construct their identities as engineering educators from a cultural perspective. For all the participants, being in the U.S. pursuing Ph.D. degrees in engineering education represents a symbol of high-quality education and the possibility to grow professionally: "*[Institution] gives me a lot of information and opportunities to take, for example, workshops, or any other similar type of activities where I can grow professionally*" (Richard). Nevertheless, they also critique aspects that may interfere with their presumed identities as engineering educators. For example, on the classroom level, Charlie and Jerry made visible how the courses privilege a U.S. centric model of knowledge and discriminate the knowledge originated in a different language from English:

> Jerry: It's very US-centric, a lot of the issues that we talked about and dealt with, especially of a political nature, are very US-focused. And, you know, coming here as a [Jerry's nationality], frankly, I really didn't care too much about, you know, U.S. issues.
> Charlie: I have realized that sometimes people in the department, they underestimate papers from other countries, because if it's not an American paper, then they would be like "I don't know much about the quality..."

On the department level, Jerry said that they expected that the program focus would be strictly on learning, teaching, and researching engineering concepts but found otherwise. They tried to make sense of this difference by saying, "*while I'm not 100% sure if that [changes in department] ... changed the focus of the research of the department, or switched the emphasis, or it may be that existed before, and it just wasn't as clear to me in my Open House visit...*" According to them, the unexpected change impacted their conceptions of engineering education and led them to question if they still wanted to continue the program.

Socially distributed resources in our study refer to the social relationships that students preserve or develop as international students studying within the U.S. In our interviews, the participants identified the various social connections they rely on to survive and thrive in the program and what is lacking. Our participants seek social relationships both in their home countries and in the U.S. They seek emotional support from family, close friends, and colleagues who share similar experiences, stories, or goals. By participating in various student organizations and cultural groups, our participants also search for a sense of belongingness. Shared experiences and backgrounds are the things most participants value when they construct their social resources. Aïssata mentioned one valuable mentor outside of the department who shared experiences and advice on dealing with microaggression. Other participants, such as Richard, Angela, and Charlie, favor building connections with fellow international students, stating that "*sometimes it's just easier to connect with international students*" (Charlie). Regarding social ties from faculties in the department, participants reported some level of support, but not to the level of their expectations. The advanced participants in the program share the feeling that their advisors

do not fully function as a mentor to provide sufficient support that they want. For example, Charlie described her advisor as available and *awesome* when they ask for help but "doesn't *have the skills to be a mentor*" and is not "*engaged in the process*" nor offers enough guidance through their career.

Regarding the absence of social resources, one emerging subtheme regarding what participants find lacking is the support for different career paths. Students who want to leave academia and choose to work in industry instead, such as Jerry and Charlie, find scarce support from the department. Participants had to rely on their own and reach out to alumni or external career consultants to develop industrial networks. Jerry found "*very little support from the department for alternative career paths*." When asked about the resources available to seek industrial career opportunities, Charlie mentioned, "*if you choose the industry path, it's on your own.*" Charlie resorted to former international alumni who went into a similar career trajectory for advice. Finally, this strategy of searching for support from other international students resonates with most of our participants' idea of lacking understanding from U.S. colleagues "*because they don't understand us*" (Richard).

Discussion and Future Work
Our preliminary results suggest that being international students, featured by both legal status and the dissonance between their self-perceived home culture and the U.S. culture, impacts their academic identity. Generally, the international students in this study share a lack of belongingness [14], [15] and feelings of not being understood, which is complicated by their legal status, language barrier, cultural difference, and daily life adjustment. These common threads limit international students from reaching their full potential in the success of their study, research, and social life. To examine the impact of the shared feelings among our participants, an additional round of interviews and further data analysis are required.

From our results, some preliminary recommendations to departments can be made. Contrary to common perceptions [27], faculties can reflect on what it means to be mentors instead of merely advisors and offer more personalized support to international students. At the department level, resources and opportunities should be provided to students seeking alternative career pathways. Based on the preliminary results, there is also an opportunity for departments to develop activities that increase students' intercultural competencies to help them bridge cultural differences. We realize that the first round of interview results was more deficit-based and focused on the lack of resources in students' identity construction process. One explanation for this might be that participants tend to focus on the negative experiences given the limited time in the interview. Another reason might be how we, as researchers, resonated with the results concerning our subjectivities and desires to make visible the struggles we face as international graduate students in engineering education during the data analysis process [28]. In the second round of interviews, we will refine our analysis and structure the interviews to focus more on the participants' overall resources. We will also consider using methodologies other than phenomenology to include our voices as researchers, such as participatory approaches [29]. After conducting a second round of interviews, we hope to enrich our final results to help departments, faculty members, and students understand how the particularities and needs of international graduate students affect the successful construction of our academic identities. We also hope that

this study can inspire further continuous efforts to understand better, support, and involve the marginalized and underrepresented populations.

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