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Science, Technology, Engineering, and Mathematics Aspirations Among Refugee Families: A Comparative, Multiethnic, Qualitative Analysis

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Abstract: In this original research manuscript, we examined how gender, race, and ethnic heritage shape the science, technology, engineering, and mathematics (STEM)-related and higher education aspirations of different communities of refugee youth and families participating in university–community organization partnerships. Families from various ethnic-based community organizations in Arizona (serving Bhutanese, Burundian, Congolese, Somali, and Syrian people) participated in this study. Using social cognitive career theory as our conceptual framework and a qualitative research approach, we conducted interviews and focus groups with 27 families over two years to better understand their experiences. We found that the youth and families in our study experienced the following: (1) a recognition of the value of STEM education; (2) the value of consistent support from parents and community members; and (3) appreciation for the practical interventions provided by the university–community partnership. Additionally, families communicated conflicting perceptions of the salience of race and gender. We concluded by discussing the implications of the study findings for higher education scholarship and practice.

Keywords: community partnership; ethnic heritage; families; refugees; STEM higher education; youth

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1. Introduction

In recent decades, the plight of refugee populations and the educational challenges they face have gained increased visibility in mainstream U.S. media and among academic researchers. According to the UNHCR (2024b), there are currently 117.3 million refugees across the globe. Ongoing political turmoil that displaced people in places, such as Ethiopia, Syria, Myanmar, Gaza, and Ukraine, has motivated scholars to focus on refugee education (Badrasawi et al. 2018; Lim et al. 2023; Kalocsányiová et al. 2022). In the context of higher education, more and more stakeholders are also paying attention to refugee issues, as demonstrated by the initiatives, such as the UNHCR's (2024a) 15 × 30 Roadmap, a project that aims to have 15% of refugees across the world enrolled in a higher education institution by the year 2030. Initiatives, such as these, offer a timely goal for the United States, which is home to over three million refugees (Refugee Processing Center 2016).

In this paper we argue that increased access to higher education in the United States—especially in the science, technology, engineering, and mathematics (STEM) fields—may facilitate smoother integration into broader U.S. society. Extant research shows that STEM education continues to be a priority for higher education policymakers and major corporations (Funk and Parker 2018). Additionally, a focus on STEM higher education and career pathways is warranted because successful and diverse STEM degree holders are necessary to meet the workforce development and job market needs of the United States (Olson and

Riordan 2012; Benish 2018; Desikan et al. 2023). We argue that a diverse student body that includes refugee students in STEM is necessary for their own social and professional mobility, as well as for enhancing U.S. technological innovation and competitiveness.

Despite the importance of the STEM fields for U.S. workforce development and broader society, it remains demographically homogeneous (primarily White and male), meaning that refugee students of color are often underserved (Rocha et al. 2022; Flores et al. 2023). Rocha et al. (2022) and Jones et al. (2018) pointed out the diversity gap in STEM education and the need to address it through strategic partnerships. An assessment of student experiences in minority-serving institutions indicates evidence of a similar gap in STEM education among minority groups (Flores et al. 2023). In the education scholarship about minoritized communities, refugee communities and their STEM educational experiences have not been a major focus. In this study, we aim to help address this gap in scholarship by examining five specific refugee communities and their educational aspirations. Accordingly, the purpose of this paper is to examine how attributes, such as gender, race, and ethnic heritage, shape the educational aspirations of refugee youth and families. We do this in the context of ethnic community-based organizations (ECBOs), which we define as institutional and community spaces of support that are conscious of people's linguistic and cultural heritage. Our study is guided by the following research questions: (1) how, if at all, do gender, race, and ethnic heritage shape the STEM education aspirations of different communities of refugee youth and families (Bhutanese, Burundian, Congolese, Somali, and Syrian), and (2) What are the similarities and differences among these groups in the context of STEM educational aspirations? Using social cognitive career theory (SCCT) as our guiding conceptual framework, we interviewed and conducted focus groups with 27 families between 2022 and 2023 to better understand their thoughts, feelings, and understandings about STEM education and related careers. Our findings from this study are important because they shed light on refugees' lived realities and how they are shaped by perceptions of STEM higher education and its potential to improve their families' lives and future. Beyond issues of underrepresentation in STEM, this inquiry is motivated by a desire to contribute to prior literature about first-generation college students of color in STEM.

2. Context for Study: U.S. Refugees' Integration and the University–Community Organization Partnership

The Immigration and Nationality Act of 1965 and the Refugee Act of 1980 were both transformative policies that have shaped immigration access to the United States (Berlin 2010; Lorenzi and Batalova 2022). Since then, the legal protections and public services available to refugees are often a political talking point that legislators, whether they are supportive or not supportive of refugees, use to garner support among voters (Asad 2023; Aleaziz 2024). For example, in December 2020, former President Donald Trump released several regulations that limited protections for refugees, including sending asylum seekers to El Salvador and introducing "a historic fee on asylum applications and 800% fee increase for appeals" (National Immigrant Justice Center 2021, p. 21). Conversely, the administration of President Joseph Biden has worked to expand the national refugee program while still attempting to limit crossings at the U.S. Southern border (The White House 2024). In 2023, 31,797 refugees came to the United States. In terms of origin countries, the largest number of refugees came from the Democratic Republic of the Congo, Myanmar (Burma), and Syria (Ward and Batalova 2023).

For this study, we focus on participants involved in a university–community organization partnership. The program comprises five distinct components: 1. a mandatory five-week workshop, held on five Saturdays, which provides STEM games and activities led by specialists, as well as guidance on college pathways and STEM majors through a program called American Dream Academy (ADA). ADA sessions offer youth and families insight into the college-going process, including workshops about applying to schools and financial aid. During each session, activities were translated for individuals who may not

have a strong command of the English language. 2. E-mentoring, matching high school students (grades ten and above) with mentors who are largely either college students or young professionals and from the same community as the mentee. 3. A community college field trip for selected families. 4. A public university field trip for selected families. 5. Summer digital storytelling. Prior related research has underscored the role of community leadership (Judson et al. 2024) and employed quantitative measures to reveal how the program positively affects attributes, such as STEM capital and college social capital (Judson et al. 2023).

3. Literature Review

This study is fundamentally an analysis of educational aspirations from the perspective of intergenerational families from a refugee background. In the context of a rich body of scholarship about refugees and education, this study fits within a broader conversation about student refugee programs (Baker 2022). This is an essential perspective to study because refugees in the United States often come from collectivist cultures where the needs of a broader group are typically more prominent than the needs of an individual person (Greif 1994; Hofstede 1998). It is important to understand the contextual factors that may motivate different communities in our study to leave their heritage country. For example, for Burundian refugees, ethnic and political conflicts during the 1993–2005 civil war in Burundi have forced thousands of people to flee from the country (Turner 2008). Meanwhile, the destructive war in Syria that started in 2011 left hundreds of thousands dead and produced the world's largest refugee and internally displaced population of around 13 million—-most of them seeking refuge in Western countries, such as the United States (Byman and Speakman 2016).

The decision of Bhutanese, Somali, and Congolese refugees to resettle in the United States stems from similarly challenging histories. Bhutanese refugees particularly migrated to the United States beginning in the mid 2000s due to political persecution, ethnic cleansing, and the stripping of citizenship rights in Bhutan, which led to forced displacement and the establishment of refugee camps in Nepal (Hutt 2005). In Somalia, ongoing civil war, severe droughts, and famine conditions since the early 1990s led to widespread violence, displacement, and a humanitarian crisis (Besteman 2016). Congolese refugees migrating to the United States were primarily driven by ongoing armed conflicts, ethnic violence, and political instability within the Democratic Republic of Congo, leading to severe human rights violations and displacement (Turner 2004).

According to a study conducted in Norway in 2020, refugees there have less access to the labor market than both non-refugee immigrants and the native population. Also, refugees tended to occupy positions that pay less and have lower professional requirements (Abamosa 2021). Similar patterns are found in the United States, as Koyama (2017) argued that finding a job in the United States can be challenging due to the uncertainties and barriers they face while trying to make a living. The level of English remains one of the obstacles that hinder the opportunities for them to access educational opportunities and enter the job market.

Driven by these harsh realities, many refugees see STEM careers in the United States as a path to stability, social status, and a sense of belonging. These aspirations embody the hope to contribute positively to their new homes. This pursuit reflects the inspiring resilience of refugee families as they strive to transform displacement into opportunities for a socially secure and financially prosperous future. Refugee youth's diverse experiences and knowledge systems foster their engagement and success in STEM learning (Ryu et al. 2019). Arguably, STEM educational opportunities are important to study because they offer people stable and well-paying careers (Okrent and Burke 2021; Zhang et al. 2024).

Furthermore, studies investigating the factors that influence students' choices have identified perceived social support and social barriers as two of the main factors that influence their choices for STEM education. The social support provided to students by their families, friends, and teachers can highly influence their choice of studying technology-related

fields (Inda-Caro et al. 2016). Alternatively, perceived obstacles in pursuing technology-related studies (e.g., gender stereotypes) negatively influence students' choice of study (Inda-Caro et al. 2016). For example, from an early age, children, including those in middle and high school, often picture scientists as male, revealing a deeply ingrained stereotype that science and technology are male domains. This bias is reflected by the lower representation of female characters in students' drawings of scientists and the association of masculine traits with STEM subjects. Such stereotypes may dissuade female students from pursuing STEM fields, despite the growing representation of women in these areas over recent decades (Makarova et al. 2019).

4. Theoretical Framework

This project is guided by SCCT, a conceptual framework for understanding how a person's individual disposition and abilities work in tandem with environmental and institutional factors to shape career pathways (Lent et al. 2002). Originally conceptualized by Lent et al. (2002), SCCT has been used widely in education research to understand attributes influencing individual choices in career aspirations. This framework argues that individuals have agency in their professional development while still operating in response to external forces. We use this framework as our guiding theory because it helps us think of STEM aspirations through a socio-cultural and political lens (Boerchi 2023). In other words, SCCT helps us think about how students and families weigh both personal and systemic considerations when deciding on college majors and post-college careers.

In terms of applications, SCCT has been used extensively in the past to study populations similar to the populations represented in this study. For example, Byars-Winston et al. (2016) offered one perspective. Using this framework, these authors called for and deployed new measures to predict persistence among underrepresented groups in the sciences and found that differences existed amongst groups with regards to race, gender, and ethnicity. The authors called for the need to expand participation of underrepresented groups in the future. Meanwhile, in a study from Bangladesh, Siddiky and Akter (2021) offered another perspective by using SCCT framing to show that determinants, including the preferences of families, advice of teachers, and job prestige were significantly associated with students' career choices. However, gender and social class did not have a significant association. Meanwhile, Međugorac et al. (2020) acknowledged the robustness of SCCT in understanding how adolescents can begin to conceptualize their career interests, especially in the environmental, social, and economics fields within sustainability. In this study, we determined that SSCT was a good fit when considering the effects of both the context, as well as barriers, to STEM career goals.

In our study, SCCT informed the types of questions we asked during the interviews and the data analysis. For example, a few questions from our interview protocol related to personal and systemic considerations are as follows:

- To students: What are your feelings about your ability to do a STEM major in college? After you graduate with a college degree, do you see yourself as holding a job in STEM? Have you thought about it? Tell me more.
- To students: Is it important that your mentors or people who advise you about your future are like you? For example, is it easier to take advice and be mentored by other _____ [insert demographic category related to race, gender, and culture/heritage]?
- To parents and students: Is there anyone who is close to you that has a STEM-related job? What is your relationship with them? What do you think of that job?

Our application of SCCT is innovative because of the education level, population, and research design on which we focus. While much of the existing SCCT literature is about students enrolled in higher education, our study examines high school students who are poised to enter colleges and universities but have not started yet. Additionally, we found that SCCT is not frequently used to analyze qualitative data or used to study intergenerational refugee populations.

5. Materials and Methods

Methodologically, we sought to use culturally responsive research approaches that honor collectivism in refugee communities (Berryman et al. 2013). Practically speaking, this meant that we prioritized building relationships with our participants and members of their cultural community throughout the research study. Partnership between the university researchers and the Arizona-based refugee communities has been built over many years through formal and informal ways. These relationships have allowed for the design and execution of the current program. The partnership program, funded by the National Science Foundation (NSF), spans five years starting in 2020 and aims to assist refugee families in the United States to pursue careers in STEM and navigate college. The project targets parents and their children in grades 7–12 and involves a collaborative effort between a prominent public university and several ECBOs representing local Burundian, Congolese, Bhutanese, Somali, and Syrian communities. Although they serve different groups of resettled people with distinct socio-political histories, all the ECBOs are committed to advancing the educational, social, and economic advancement of their respective community members. A few examples of services offered are a platform to share cultural events (Burundian, Bhutanese, and Syrian ECBOs), citizenship and naturalization preparation classes (Somali ECBO), and access to digital literacy training (Congolese ECBO).

5.1. Data Collection Procedure

We used a qualitative research design and a phenomenological approach (Marshall and Rossman 2014). In our study, the shared "essence" is the formation of aspirations for STEM majors and careers among participants (Lin 2013). Our team interviewed 27 families identified by the ECBO community leaders, from amongst those attending the mandatory five-week workshop as part of the project. They were interviewed multiple times over a two-year span (2022–2023) using a semi-structured interview design, and three families of the Bhutanese community participated in a single focus group. Each family usually consisted of at least one parent/an adult sibling and student. A few times, a younger middle-schooled sibling also participated in the interviews. Each family was offered a gift card payment of USD 25.00 as compensation for their participation. Though the education level of parents was not explicitly asked in the interviews, all had some sort of schooling. It is important to point out that the Bhutanese families were the final community to join the program in 2023. At the time of writing this manuscript, the researchers decided to ensure inclusion of this group but given the limitations of time, only one focus group interview involving Bhutanese families was included. A single focus group with three families of parents and their respective high school students was conducted, instead of separate interviews with each family, as had been done with other ECBO groups.

5.2. Ethics Protocols

Prior to the start of the study, the principal investigator for the broader study submitted an application to the host university's Institutional Review Board (IRB) office. Our research team received IRB approval after the review of all data-collection instruments (including surveys, interviews, and focus group protocols). Since this study involved a vulnerable population (i.e., refugees), the project was rigorously evaluated for the following: upholding ethical standards, compliance with federal regulations, and protection of research participants.

5.3. Data Analysis

Because this study is based on a phenomenological design, we sought to make sense of the qualitative data from the subjective perspective of the participants and bracketed our own assumptions (Qutoshi 2018). Interviews for this project were conducted in English, Somali, Arabic, and Nepali and audio recorded. In instances when data were collected entirely in English, the first step of data analysis involved having audio files professionally transcribed. In instances when collected in non-English languages, audio files were transcribed

and translated via a professional transcription service and then re-checked and verified by the researchers who conducted those interviews/focus group. This verification process involved filling in missing words, checking for textual errors, and editing for grammar and meaning. In doing so, we maintained fidelity of the participants' original ideas.

We analyzed interview and focus group data via multiple rounds of qualitative coding. In the first round of coding, we actively read each interview transcript and annotated key words and phrases that could serve as primary codes. Examples of primary codes included the following: "identity", "memories of refugee camps", "Burundian culture", "Black women", and "impact of [redacted ECBO name]". While reading and annotating, we kept tenets of SCCT at the forefront of our minds. Per the guidelines of a thematic analysis approach (Bernard et al. 2016), we read the transcripts multiple times to familiarize ourselves with the experiences of each family. These initial codes were conceptually "close" to the original data.

In the second round of coding, we noted short phrases that appear multiple times in the transcripts and corresponding textual evidence (i.e., direct quotes). In this step, we utilized the constant comparison method to identify patterns in previously analyzed text (Glaser and Strauss 2017). We employed an inductive coding approach to group the initial codes into larger clusters. We also noted important patterns, similarities, and contradictions between the different ECBOs.

In the third and final round of coding, we reviewed all codes, researcher memos, and direct quotes and clustered the sub-themes to construct overarching themes that we used to present our findings. As a collective of researchers, we also engaged in multiple analytic conversations with one another to triangulate our notes with observations made by different members of the team. For example, Nalini, as a Nepali speaker, was privy to the cultural nuances and historical experiences of the families who participated in the focus group. When analyzing the focus group transcripts, she kept this experiential knowledge in mind as she read and organized data. Additionally, because all the authors had an opportunity to interact with families during the work components of the university–ECBO partnership, we had many opportunities to triangulate and internally validate the findings. Throughout the duration of the partnership, we ate lunch with participants, sat with them in classrooms during STEM activities, and chatted informally as we walked from one building to the next. The insight gleaned from these many interactions with families is valuable and lends credibility to our analysis. We used interview/focus group transcripts, our own observations of families and our researcher discussions to craft a clear message that summarizes study data (Ennals 2009).

After conducting three rounds of qualitative coding, we arrived at three analytic themes: (1) a recognition of the value of STEM education; (2) the value of consistent support from parents and community members; and (3) appreciation for the practical interventions provided by the community–university partnership.

6. Authors' Positionality

Our study involved a diverse group of participants with varied cultural, linguistic, and educational backgrounds. Similarly, the researchers involved in this study have varied backgrounds. To provide context for methodological decisions and our philosophical assumptions, a discussion of author positionality is included (Martin et al. 2022; Secules et al. 2021).

Meseret is a faculty member in an Institute of Higher Education. As a Black woman and Ethiopian immigrant, she has intuitive knowledge about the challenges, opportunities, and affective dimensions of pursuing education in the U.S. context as an African newcomer (Hailu et al. 2022; Morrison and Hailu 2023).

Setrag is a Ph.D. candidate in Educational Policy and Evaluation. His background is teaching languages to non-native speakers, curriculum design, and translation. As a fourth-generation Armenian Genocide survivor who grew up in Damascus and lived in several countries, the topic of educational attainment for refugees is relatable to him even if

he did not experience it firsthand. Setrag recognizes that wars and displacement are two issues that affect education. According to Setrag, people should be tolerant toward each other and create safe spaces to include everyone in their societies.

Mohammed is a Black man from Ghana with a deep-rooted appreciation for cultural diversity. He is currently pursuing a Ph.D. in Educational Policy and Evaluation. His research interests include finding ways to advance the aspirations of disadvantaged students, such as those of a low socioeconomic status, in STEM. Mohammed's work is based on the belief that every individual deserves the opportunity to pursue their dreams without any impediments. He also believes that his position as an African individual who has lived in multiple countries has given him an advantage in better understanding the perspectives and contexts of fellow Africans (immigrants) who participated in the study.

Bruno is a Ph.D. student in innovation in global development from Lebanon, now living in the United States. His research and professional experience are focused on human and sustainable development affairs, as well as on policy and advocacy. His active involvement in social movements and activities while growing up shaped his deep interest in the welfare of vulnerable populations, especially those affected by the continuous conflicts in the Middle East. Having personally and professionally experienced first-hand involvement with support programs for refugees and migrant workers, in addition to having worked on local and regional political affairs, his personal views, beliefs, and observations could impact his positionality regarding the research.

Saida, the fifth author, is a Black Somali woman and qualitative researcher. She has experience working in government, academia, and international and local non-profit organizations focusing on education, refugee, child welfare, youth, and gender issues. Prior to receiving her Ph.D. in Learning, Literacies, and Technologies, she planned and led multi-million-dollar operating programs that provided sustained and transitional services for up to 5000 African, Middle Eastern, and Asian refugees per year. Her personal identity and professional insight into African communities help her deeply connect with the research participants, especially families from Somalia.

Nalini is a faculty member of South Asian heritage. She is a naturalized American citizen and has lived and worked in countries in the Global South studying inequality among vulnerable and marginalized communities through the lens of global development and education policies. She has studied the immigrant experiences, including work with the refugee communities in the United States, and leverages her own experience of personal discrimination based on gender, ethnicity, caste, and geography to explore and understand inequality.

Finally, Eugene is a White male faculty member in a school of education. His scholarly collaboration with ECBO leaders in the Southwestern United States was borne out of organic conversations and a shared commitment to volunteering at a refugee-serving non-profit organization. He has built long-term relationships with these community leaders and shares the vision to support and advance their respective communities. As the principal investigator for the broader project, he is responsible for overall decisions regarding data collection, analysis, and research outputs.

As researchers committed to critical, humanizing inquiry, we tried to create conditions that would be most respectful and culturally responsive for our participants (Tuck and Yang 2014). Also, insights from extant literature about refugee experiences in and out of STEM education informed the study design (Tan and Faircloth 2023; Cureton and Aguinaldo 2024). For example, we interviewed parents and children together to give them an opportunity to have a shared discussion about student aspirations, recognizing that many of these families are coming from collectivist cultures where educational attainment is considered a communal pursuit. This communal commitment is affirmed in existing scholarship (Gitau et al. 2023).

Additionally, whenever possible, researchers conducted the interviews in a shared language with participants to allow the families to communicate freely in their native language and respect their cultural knowledge (Morrison and Hailu 2023). To this end,

Setrag and Bruno, who are both fluent Arabic speakers, conducted the interviews with most Syrian families in Arabic. Similarly, Saida conducted interviews with Somali families in Somali, while Nalini conducted the focus group with Bhutanese in Nepali. In instances where the researcher did not speak the same language as the study participants, researchers often relied on the youth in each family (who were usually fluent in both English and their parents' heritage language) to translate on their behalf. We did our best to be respectful and leveraged our own diverse insight about the cultural context of the families in this study.

7. Findings

In this section, we summarize the responses from the refugee youths and their parents of five different ethnic backgrounds: Bhutanese, Burundian, Congolese, Somali, and Syrian. Overall, we found that gender, race, and ethnic heritage shape STEM education aspirations in different ways. We found certain perceptions and attitudes shared among all groups. First, families of all ethnic groups tend to think positively about STEM education and the financial potential and career opportunities it provides for students' future in the United States. Second, the parents are, in general, supportive of their children's choices and decisions that lead to securing a respectable life through STEM careers. Third, the university–community partnership has a notably positive impact on all families, both parents and youth, as it builds confidence in how to navigate opportunities and options in high schools, in the short term, and assists them in navigating higher education/career opportunities that they have for building a life, in the longer term.

We found that the impact of the partnership program undergirding this study seems to increase youth and families' STEM capital, which suggests that many schooling and higher education settings are not adequately creating the conditions to cultivate refugee students' STEM aspirations. Meanwhile, there were differences between groups based on their perceptions of race and gender and how these identities shape educational experiences, often depending on the number of years they have been living in the United States.

7.1. Positive Perception of STEM Education

The families in this study enrolled in a university-sponsored program known as ADA. The Center for Community Development and Civil Rights at Arizona State University designed the ADA to help address the low enrollment rates for minority or disadvantaged groups, such as Latino students, in higher education. ADA is meant to provide insight into higher education to parents in school settings and establish partnerships among families, schools, and community organizations. The goal of the ADA is to empower parents by providing them with tools and resources to support their children's education and guide them in their pursuit of academic success (Pstross et al. 2016). Since ADA was established in 2006, it has impacted over 30,000 parents and guardians. Additionally, approximately 7000 high school students have successfully completed the program. More than 80,000 children have benefited from the participation of their parents in the program (Arizona State University 2015).

Among Burundian families and youth, participants expressed positive feelings, attitudes, and understandings about STEM and STEM careers after participating in ADA. While some Burundian students talked about experiencing a confidence boost from ADA, others highlighted the potential impact of STEM on individuals and societies. To this end, one of the participants remarked the following:

> I feel like personally, if I were to go into those types of [STEM] careers, I would be able to excel in them and really be able to help in those types of careers, [. . .] I feel like I'd accomplished enough to be in them, personally [. . .]". (Burundian student)

For Congolese families, most interviewees described STEM subjects as harder than non-STEM subjects but acknowledged that studying STEM would lead to better careers, a higher income, and improved social status in their local communities. Furthermore, there appeared to be unanimous consensus that a college education would allow them to help

their community and society in general. "Everyone needs a job" was a common refrain among respondents. Many of the families' aspirations were cultivated through their own lived experiences. For example, one student stated the following:

> He [student referring to his father] said he's jealous because he came with kids to this country and he wants us to be working in the office stuff, so [. . .] we can become, our life can become a better life. We can live in a good house and stuff like that. (Congolese student)

At the same time, while the perceptions of STEM were mostly positive among Congolese students, a few of them expressed the sentiment that STEM subjects were hard and sometimes boring. Still, a few of the students remarked on their growing interest in STEM because of fun and engaging science labs they had opportunities to engage with in high schools. One high schooler remarked "[. . .] because the experiments we are doing in science. The activities are fun".

For Somali families, both parents and youth expressed a desire to enter the STEM field because of the potential financial benefits. One parent, when describing how he would feel if his son became an engineer, explained that he would be happy because his child would have access to "[. . .] a lot of money. Good money. He takes care of me. That's why I'm excited" (Somali parent). Another parent, who worked as a science teacher in Somalia, shared similar sentiments. He wanted his children to achieve in the U.S. what he has not been able to achieve because of the systemic barriers in both his heritage country of Somalia and his new home in the U.S. To this end, he described his desire for his children's social mobility clearly in the statement below:

> I regret that I did not get to use my science degree in America. I was a brilliant student; I excelled in math and science. If Somalia was stable, I would have been someone important there. Especially now my country would benefit from scientists. But my children can achieve what I did not, and they can live a better life than mine. There is so much that you can achieve if you do the sciences. This is what I tell my children. It is the only way to earn good money. (Somali parent)

This parent's background in STEM provided human and social capital that arguably contributed to his children's potential choice of a STEM career. One of his children aspires to be a physician assistant, and at the time of the study, was participating in a high school program that offered dual enrollment in college courses. His child had taken several science classes and remained knowledgeable about STEM-focused career paths.

Overall, the aspiration for a better life was particularly crosscutting for all Somali families involved in this project. The hope that their children's lives would be better than theirs propelled parents to be supportive of their children's aspirations in the STEM disciplines. Consequently, Somali parents and their children were also motivated to contribute to their communities, both in the U.S. and Somalia, through remittances and other forms of monetary and non-monetary contributions. Families imagined a career in the STEM field as a gateway for such impact. For example, parents aspired that their children would contribute meaningfully to their communities in the U.S. as one father shared "We need to encourage our children to do science so that they can help the community here in the U.S". One mother spoke about the contribution Somali youth could make back home when she stated "They are the ones who can make a difference in the situation back home". These two instances highlight how Somali parents desire to give back to their communities, both near and far, through their children's careers. Such desire was a driving motivation for supporting their children's STEM education.

For Syrian families, although their perception of STEM was ultimately positive, the concept of it was at first difficult for the researchers to adequately communicate. The conglomerate idea of "STEM" was perceived as new and Western, especially because an equivalent term in Arabic does not exist. This matters because Arabic is the primary language of instruction back in their home country of Syria. For some parents and youth, "technology" comes to their minds when they hear the word "STEM" when no further

explanation was provided. To be clear, we are not saying that the Syrian families did not understand the individual concepts of science, technology, engineering, or mathematics. For example, many families described how becoming a doctor or an engineer is a major goal for many Syrian people. Instead, we are noting how the acronym "STEM" itself was unfamiliar to them.

Moreover, for Syrian families, education remains a crucial goal to secure a better future in the U.S. One parent shared "We would be sure to encourage and support them, give them hope, opportunities, and so on", as she described how supportive she is of her children's choice of study. Another parent stated how she would be proud of her son no matter what he studied but would be even happier if it was in a STEM-related major. She explained, "If he studies chemistry, he will create medicine for those who suffer from cancer and this will make me proud as any mother of a child like that would be". According to many Syrian parents, financial well-being is another reason that gives value to education and careers in STEM. From rocket science and machine engineering to veterinary science and dentistry, Syrian families sought different careers to pursue and work towards achieving their STEM-related education. "I mostly think about the science part. I think of rocket scientists, just sitting there trying to figure out designs or something along those lines, I guess", said one Syrian student. According to the Syrian families, people who work in STEM are intelligent, hard workers, and people of value. One parent added "People who have a career in the STEM domains are very respected people and intelligent". Interviews revealed that most of the Syrian participants think highly of people who work in the STEM domains and that is a reason they encourage their children to pursue education in one of those fields. One teenager stated "People who work in STEM careers are very smart people, people who work in these fields are successful and I would like to be like them". Families perceive that getting an education in STEM at the college level likely guarantees a better future for youth, specifically for the newly arrived Syrian families, who are trying to integrate and thrive in the U.S.

Additionally, the appeal of STEM education seems to draw in younger Syrian refugees. Even if they might not grasp the full scope of what STEM entails, youth appear convinced of its outcomes, including the following: a better life, financial security, and the prestige that comes with well-regarded professions. They shared how in many Middle Eastern cultures, professions such as lawyers, doctors, or engineers are not merely jobs—-they are symbols of high social status and economic mobility. One Syrian father sheds light on this sentiment. Speaking of his sons' aspirations in STEM, he said "A STEM career gives value to people. I want my sons to be a million times better than me. I will do my best and give them what they need to excel". Beyond recognizing the academic challenges ahead, the parents showed a deep understanding of the emotional and personal support their children will need to pursue STEM careers.

As with all other groups in this study, for the Bhutanese families associated STEM careers with improved social standing, prestige, and pride. They spoke in terms of how their children could give back to society and their individual communities if they pursued STEM careers, such as medicine. Parents described the happiness and pride they would feel if their children took on STEM careers. One parent explained the following:

> If the children think of and then have careers such as doctors—then I would become very happy and proud. We have come to this place, and they have become doctors—that would make me immensely proud. To become a doctor is not a small thing, especially for people like us. So, it would make us immensely happy.

For Bhutanese parents, the differences between U.S. high schools and their own high school experiences created a barrier. This is because Bhutanese parents felt like they could not fully advise their children about which classes to take, since their own high school experiences had extremely limited course options. By participating in ADA, parents became aware of GPAs, minimum requirements for high school graduation, flexibility in choice of classes, college choices, and financial aid options. Having enhanced insight about U.S. high schools in this manner allowed them to have more open conversation with their children.

Bhutanese parents regularly expressed how much they had learned about the college-going process through ADA interactions.

Furthermore, Bhutanese parents pointed out that STEM activities they learned in ADA sessions allowed them to be aware of the vast choices of STEM careers beyond the well-known options of medicine and engineering. Parents were grateful to be exposed to that kind of information because they viewed STEM education as a vehicle for freedom. One parent was insistent on the importance of higher education in allowing greater freedom of ambition for his children. He discussed how education would allow his children to be independent and not be exploited by political powers—-a clear reference to his own past traumas of subjugation that he had faced as a refugee. He was determined that his children would not be subjected to such experiences. He explained the following:

> that they [his children] are not dominated and exploited by others. That they are free and independent to do the things they want to do. They are able to live their lives openly as they wish and be independent. That they do not have to live under the shadow of others or be dominated or exploited by others. That they are happy and free to do whatever they wish.

One Bhutanese high schooler noted that STEM subjects were hard, but he still liked math. Like the Syrian families' understanding of this idea, the acronym "STEM" was not familiar to many Bhutanese youth. However, individual subjects, like math and science, were recognizable to all of them. They were also inspired to pursue STEM by their teachers. One Bhutanese student remarked "I'll just be listening to my teachers. They're my main inspiration to go into STEM and I had this one tech teacher, and he would just really nail us about STEM and schools".

Overall, families from all ECBOs—-including the Burundian, Congolese, Somali, Syrian, and Bhutanese—-held similar positive perceptions of STEM education and careers. All the parents interviewed were fully cognizant that higher education was a key to a better life in the United States and STEM education was an important component of that social mobility.

7.2. Value of Consistent Support from Parents and Community Members

Another major theme in our data was parents' enthusiasm for their children's educational and career choices. For example, Congolese students and parents voiced the importance of family support for going to college and in choosing a career. They agreed it requires hard work and having dreams. One Congolese parent pointed out the following:

> If you want to be successful in college, high school, you have to work hard. You always ask for help for what you never know. Yeah. . .I must say work hard and have dreams. Having dreams, like setting goals. What do you want to be? What do you want to do and everything? How are you going to do everything? [. . .] I'm a supporter by encouraging them to do what they want. Follow your dreams and then one day you're going to become something.

For Syrian families, refugee parents consistently expressed a preference for their children to pursue STEM education and careers. They demonstrated a readiness to provide the necessary support, both emotionally and financially, to help their children achieve this outcome. While there was a collective acknowledgment among parents and students that STEM fields might not be suitable for everyone, they believed in the availability of multiple educational paths, including technical and vocational training. A Syrian parent of three remarked: "Some children do not like going to school; they might be more interested in trades like barbering or electric work, perhaps following in their parents' footsteps".

Bhutanese parents seemed unanimously supportive about their role as parents in guiding their children in high school, first in education and then in their STEM careers. A mother also acknowledged that her children's dreams would change over time as they grow older. To this end, she remarked the following:

> the thing is that they are teenagers. They do not always listen to what parents are telling them. Things are changing for them. Parents have to understand all the changes our children are going through. They should not get angry at their children. We also underwent the same experience. We must not get angry. They will not understand that we are trying to persuade them and to help them. As teenagers they do not understand or listen to parents. But no matter what—we have to pay attention to our children at home.

One Bhutanese father pointed out "When the children study, they cannot do it alone—we, as parents, must lend our support. Everywhere we must provide our support and encouragement. Then only will they do well in the future and rise". During ADA sessions, parents became familiar with the different nature of U.S. schooling. Such awareness allowed them to say that they felt more confident supporting their children. Furthermore, the idea of hard work was a recurring finding: One father said the following:

> We use [our past] experiences [as refugees] to tell our children that it is likely that if you do not study then it is likely you may end up in the same situation. That was our lives. So, we tell them they can make their own future by studying hard. Studying is for your own good. It is not for us. Studying is for their own future, not ours. We have lived these experiences so you should not have to do that. It is in your hands to shape your future. So they listen and absorb it [. . .]"

Another Bhutanese parent pointed out that it was important that if the families wanted their children to adopt STEM careers, then they should ensure that students first take interest in and feel supported to pursue STEM subjects in high school. This interest would eventually lead to students adopting STEM careers later. This parent said the following:

> I think that and I hope that my children will try to do these careers but before that I would like them to sincerely study these STEM subjects and fields first. I would hope that they do well and succeed in studying these fields and subjects. If they are successful in studying these subjects, then it will be easier for them to choose these careers, but they have to study them first. That is what I think. If they do not study these subjects at all or are not interested, then it will not be easy for them to take up these careers afterwards.

Parents' support of their children's choices of subjects they chose in high schools was common across multiple ECBOs.

7.3. Beneficial Impact of University–ECBO Partnership

Families across different groups also shared how the university–ECBO partnership was beneficial. For example, many Burundian refugee families, particularly the parents, expressed a distinct lack of exposure to STEM prior to their involvement with the partnership project. For many parents, this is attributable to the challenging circumstances they encountered in refugee camps prior coming to the United States. Furthermore, aside from their refugee status, many of the parents were uneducated, which further compounded their limited knowledge of STEM. The following are the comments shared by some of the participants that illustrate this point:

> To be honest, there was a lack of education back there, specifically within the refugee camp that we were in. So, there wasn't much toward education or schooling. In the last refugee camp that I was in, we didn't actually have any schooling available until we came here. (Burundian parent)

Similarly, another Burundian parent stated the following:

> There was no schooling [. . .] I wish there were, or I had some information about STEM during that time [in a refugee camp]. [. . .] I had no idea about STEM at all. But if they had any STEM programs, then I'm pretty sure it would've helped a lot. (Burundian parent)

Among Congolese families, the parents perceived the university–ECBO partnership as an activity that educated both parents and students and boosted confidence. Congolese parents noted the need for such programs on a regular basis. To this end, one Congolese youth, translating for a parent, shared the following:

> She's [student translating for the mother] just saying the only thing she can say is [. . .] for what you guys are doing and she want you guys to continue doing what you guys are doing so we can be better as you guys. Yeah. (Congolese parent)

Underlying some of the conversations with Congolese families were notions of uncertainty about the future. This uncertainty led some to wonder if college was in their future. So, parents and youth welcomed a program such the university–ECBO partnership, which not only informed them but also gave them confidence and insight about what college would be like.

The Bhutanese parents expressed their gratitude for being associated with the program as part of the university–ECBO partnership. They said that this partnership made them feel special, allowed them to come to campus, and experience what attending college feels like, and that they get to interact with members of university personnel, such as professors and students. That experience also boosted their confidence in dealing with interactions within schools and with their own children. They found the program to have extensive information—-sometimes overwhelming, but all relevant. A parent remarked the following:

> These weeks have taught me a lot. We learned a lot about things we had never known before. Our children too learned a lot. I know we will continue to learn in the remaining weeks. It has been fun, and I am happy.

Meanwhile, the students' reactions were mixed. In many cases, they were aware of the working of the high school systems, which the ADA program emphasized, so there were only some elements that were new to them. However, the content of the ADA was new to the parents and allowed them to become more familiar with U.S. high school systems. Consequently, this awareness gave parents confidence in talking to their children about different aspects of schooling, such as GPAs, classes, and Advanced Placement classes, most of which parents had never experienced in their own countries. Furthermore, the students liked doing this program along with their parents and community leaders, which gave them a platform to interact and become closer.

Overall, the parents expressed positive feelings and praise for the university–ECBO partnership. They appreciated the impact the partnership had on building their confidence to navigate the opportunities schools had to offer in STEM education and in their newly gained ability to have conversations with their high-schoolers about the value of STEM subjects and careers.

7.4. Conflicting Perceptions of Identity: Race, Gender, Ethnicity/Culture, and Religion

This study revealed the frequently conflicting role of race and gender in shaping the aspirations and perceptions of different communities of refugee families. Burundian participants reported that the impact of gender, race, and ethnic background on their desire to pursue STEM varied depending on the context, such as classroom settings and the identities of mentors and STEM teachers. Often, participants had mixed opinions about diversity in the classroom. While some believed that being different in class had very minimal or no impact on their STEM and general academic lives, others thought that their differences, particularly their race and gender, had some level of influence on their academic life and success. One Burundian student remarked the following:

> It does not matter to me because most of the time I normally speak to people from where I'm from or from different countries like Mexico, Japan, or some people from China, too. I normally communicate with them to learn about their culture, too.

Another Burundian youth shared the following:

> Yeah, sometimes you get discouraged because, when you walk into class, you feel like you're the only Black girl. And it is like everybody else just fits in, and you stand out in a way because you're colored. [. . .] I could do it; I'm going to show them that you don't have to be Mexican or something like that. You can be Black and still be great.

When asked if it is important to have mentors who share a similar race, gender, or ethnic heritage, many of the participants (students) revealed that it is vital.

> [. . .] I want a woman mentor [. . .] I feel like I'm more likely to get closer with someone who has more similarities to me. So, if it's a woman, I'm more likely to open up or get closer to them more quickly than I would for someone I'm not very close to. So, I think it's just those little, small aspects. (Burundian student)

> I think it matters. I want people to talk to me about my future, but they should relate in a sense. If it's somebody who's from somewhere else who has no interest in what I want to do, who doesn't know the struggle that I go through, who never lived my type of lifestyle, who lived the exact opposite of me, I feel like you can't give advice based on your experience. And your experience and my experience are nothing alike. (Burundian student)

Much like the Burundian refugee communities, the Congolese families and youth articulated how their identities shape their STEM aspirations differently. The gender, race, and ethnicity of the participants played important roles in how they wanted to pursue STEM careers, though it was affected by the classes they took, mentoring of teachers, and support at home by parents. Many students understood the importance of STEM and role models. For example, a Congolese student explained the following:

> [. . .] it's just empowering in general and coming from families where we came here for education and to see that the people who came here to get education are now having careers in these big STEM places. Yeah, it's just empowering.

On the importance of role models, another Congolese student remarked the following:

> [. . .] But honestly, I feel as far as STEM in our community, something that we really need people to go more into sciences and be doctors and stuff like that. Because I feel like in our community we need more little somebody, kids growing up they can have somebody they can look up to. Cause I don't think we really have that. I feel like everybody kind of does the same type of job because it takes one person to unlock something for everybody else to follow.

Similarly, another Congolese student shared the following:

> Okay. Well, I started thinking about that when I was a kid back in Africa. I just thought it was something cool. Whenever I see somebody who's wearing the nursing uniform and stuff, I get so jealous, like I just want to be that person. It's just something that I want to do. It's not like I saw from somebody. It's something that I have wanted to do since I was a kid.

For Congolese families, diversity did not seem like a key factor for the youth, though the ability to speak the same language to communicate was viewed as a plus. Exposure to systematic STEM learning was viewed very positively. The design of the university–ECBO partnership allowed youth and their families to understand, in a deeper manner, the diversity of STEM careers. The partnership also provided some guidance on enhancing their abilities and knowledge to reach their STEM career goals. Among Congolese youth, gender and race appeared to have an influence with some high schoolers remarking that women role models were important and that when there were mentors/teachers of a similar gender and race, then it was easier to ask about experiences and aspirations as there would be more relevance. A Congolese family with two sisters remarked on institutionalized

gender expectations, in terms of girls and boys in the homes, where boys were given more freedom than girls, though in their case, their parents had similar expectations for all their children. In many of the Congolese interviews, STEM was a hard concept to wrap their heads around initially. A Congolese student clarified the following:

> So, he said what he feels about science, when he heard those stuff about science, he feels like someone that can create your own stuff. Like you know how science, you can create stuff like a microscope. Yeah. So, you can create your own stuff, that's how he feels. [student speaking for himself on the understanding of STEM] I'm going to say math because I just feel math, I can do a lot of stuff like this number that you go with numbers.

Another member of one of the Congolese families remarked "We came here for education and saw that the people who came here to get an education now have careers in these big STEM places". Many of the Congolese families expressed the desire to see more women of color in STEM professions. They are interested in jobs in science, programming, and robot construction. They believe that employment in the technology sector is crucial. According to a Congolese parent, "We need scientists, engineers, and people of all those professions because I feel like the world has advanced through those people". For this parent, diversity is both necessary and beneficial. Another Congolese student shared: "I wish I had more Black kids in my class".

Still, one of the young Congolese students stated "but to be honest with you, no, I don't care about the race". For many Congolese participants in this study, the race of teachers, mentors, or classmates did not seem to matter on the surface, but later on, it did seem to hold significance. These contradictory perceptions of race and racialization reveal an important conflict that Congolese youth may be facing when reconciling how they see themselves versus how others see them in the United States.

Unlike the Burundian and Congolese families, Somali families did not identify race as an influence on their decision around career. More than race, the families and their children identified familial mentors and role models as reasons that factored into their STEM aspirations. One student spoke of how he was inspired by his uncles to become an engineer, and he shared the following: "All of my uncles are doing something with math, and they make it seem cool and it makes me want to be an engineer". Another parent shared how she was inspired by her nieces' journey to becoming nurses and she said "Because my nieces are nurses, my daughter has someone to follow and now she wants to be a nurse. It will be easy for her because they can help her". As seen in the above and prior accounts, familial capital was a salient shaper of youth and family aspirations for STEM careers.

Similarly, gender and ethnic background were not a salient dimension of the family and youth identities for Somali families. When they were asked whether studying among fellow Somalis or students of the same race and gender with them mattered, one student responded "Their race doesn't matter. It just matters that they are good people". However, religious values were a salient theme among the Somali families. While youth did not speak much about religion, their parents spoke about it as a principal element of their identity and as playing a part in shaping their aspirations for a STEM career. A few parents alluded to how they perceived a STEM career as fulfilling religious obligations. One parent, for example, suggested how a STEM career was a vehicle for solving human suffering when he stated "In Islam, someone helping the weak has achieved much. A career in science allows you to help people and it is a good way to fulfill Islamic duties". He made the above statement within the context of his children contributing "back home" and helping hospitals that healthcare providers. Another parent spoke about how he found a Muslim mentor to guide his son, stating "I took him to an after-school program and one of the teachers is going to college to become a nurse. I want him to have Muslim role models". The above sentiments point to Islamic values as having salient dimensions in family and youth aspirations around STEM career goals.

Among the Syrian families, demographic background, ethnicity, or being from the same race and culture as instructors, classmates, or mentors does not necessarily affect their classroom learning experience. Instead, they seemed to be mainly focused on the many opportunities afforded to them in the United States. For one Syrian parent's teenage sons, their new U.S. cultural environment does not shape their determination to grow academically and professionally. When asked a question about his preference for studying among fellow Syrians or Arabs, one son replied "Nationality doesn't matter. It makes no difference". Gender, however, presented interesting distinctions. Among male students, the prevailing sentiment was that STEM fields offer opportunities for personal growth and success. Conversely, female students viewed professions within STEM, such as medicine, as beneficial for societal progress and essential for improving lives. One eleven-year-old Syrian girl described STEM professionals as "individuals we turn to when faced with specific challenges". Generally, STEM raises curiosity for the teenage Syrian students in this study and they are mostly interested in learning and exploring this field more. "I believe I have somewhat of an understanding of STEM careers. I'm thinking about becoming a biomedical engineer, which involves a medical background as well as a lot of coding", stated a male teenager who is going to college soon and has career dreams related to STEM.

However, learning English remains a barrier for some of the Syrian parents whose language level does not allow them to fully integrate into society, unlike their children, who are learning and excelling at English. Regarding the context of studying amongst peers or mentors of similar cultural and experiential backgrounds, the consensus among families was that it would not pose any significant issues. However, a subset of families felt that involvement in a community with shared backgrounds could be advantageous, as the Syrian father of a teenage son stated "being surrounded by people who speak our language and know our culture will create a better learning environment for us".

For the Bhutanese students, race and gender were not factors that were influential in their lives. However, the parents felt that the status of the families as former refugees would, in some cases, influence school educators to lower expectations in terms of recommending students toward more rigorous courses. The students felt that their parents, if they had come to the U.S. as children, would have flourished in terms of their career growth. One parent reflecting on that notion and conversation with his son:

> Living as we did was so hard. And when we tell our children our experiences—what our children say is that—yes—it was difficult. But the fact that you brought us here- our children will firmly say- that you brought us here is very fortunate for us. It was fate. What my son says is—Daddy, if your parents had brought you here at the same age as me then you would have been someone important here and you would have done something worthwhile here. He says that.

Overall, amongst the Bhutanese parents, there was no apparent distinction of which STEM careers were suitable to their daughters versus their sons. They wanted both their daughters and sons to have the option of choosing any STEM career.

8. Discussion and Scholarly Implications

Based on the study findings, the main commonalities among the different groups were as follows: (1) all communities think positively about STEM education and the financial potential and career opportunities it provides for their future in the United States; (2) parents were generally supportive of their children's choices and decisions in all groups of the study and want their children to succeed by securing a respectful life through STEM careers; and (3) the university-led program had a positive impact on all families, providing them with the tools to navigate and pursue the various opportunities available for them, which they believed enables them to build better futures for themselves. Despite sharing the similar experience of being refugees in the United States, the groups' views on the role of race and gender were not aligned, possibly since they have different backgrounds and experiences. In the pursuit of STEM majors and careers, race and gender are considered by members of the Burundi and Congolese groups, but not by the Bhutanese, Somalis, and

Syrians. Furthermore, for the Burundi and Congolese individuals, the identity of their STEM mentors and teachers holds weight, whereas it does not for the Bhutanese, Somalis, and Syrians. When understood through the lens of SCCT (Lent et al. 2002), the first finding also reflects the agency of individuals in shaping their own career trajectories. Meanwhile, the second and third findings show how social and institutional factors can help cultivate career possibilities and desires.

The finding related to greater weight placed on ethnic and cultural heritage versus race and gender is especially valuable and quite aligned with what we have informally observed among the communities, particularly among the community leaders. It is a nuanced and important finding, as researchers are too quick to generalize the attributes of groups under the same monolithic umbrella. However, these assertions from refugee families do not mean that race and gender are structurally relevant for a student's socialization in STEM spaces. STEM classrooms are socially constructed; they are not asocial or identity-irrelevant spaces. Instead, interviewee responses about race and gender irrelevance can reflect strategic ways that participants protect their marginalized identities in post-secondary STEM spaces plagued with inequities (including racism, misogyny, and linguicism) that disadvantage refugee student populations.

As a whole, our study extends the work of past scholarship on this understudied population. Studies, such as Judson et al. (2023), Çakir et al. (2022), and Prasad et al. (2016), support the idea that engaging refugee youth and parents in STEM activities and programs yields a positive impact on their attitude and perception toward STEM, as well as their aspirations to pursue STEM majors and, ultimately, STEM careers. Judson et al. (2023) found that involving refugee parents and students in STEM workshops improved their perceptions and aspirations toward STEM fields, enhancing college and career readiness for refugee families. Related, Çakir et al. (2022) discovered that engineering design-based STEM activities positively impact Syrian refugee students' attitudes, leading to their improved sense of school belonging and social development. Moreover, Prasad et al. (2016) found an increase in the interest of refugee high school students in STEM fields after participating in programs, like Biodiversity and Computer Construction, which aim to motivate them toward science and technology.

9. Study Limitations

Like all research, this study was subject to multiple limitations. First, the use of multiple actors in the data collection and analysis process means that key ideas may be lost as information gets translated. For example, among Syrian families, data were collected by more than one person, transcribed and translated by one person, and then analyzed by the entire research team. During this process, key ideas and non-verbal information from participants may be lost in translation. Additionally, data collection may have been negatively impacted by the constrained time. Interviews were frequently conducted during the lunch breaks of the weekly meetings of the university–community partnership. Oftentimes, there was limited time and ambient noise/distractions that may have jeopardized the quality of the interviews.

There are also limitations to a comparative design. We do not have the space to go in-depth about each group and robustly contextualize the history and sub-culture of each group, language, history, and conflicts in heritage countries. There is also limited time for a within-group analysis. For instance, Burundian refugees who recently arrived versus Burundian refugees who have lived in the United States for decades have vastly different approaches to educational attainment.

10. Conclusions

In this research project, we explored the participation and representation of ethnically minority students in STEM education pathways.

The research questions that guided our study were as follows: (1) How, if at all, do gender, race, and ethnic heritage shape the STEM education aspirations of different

communities of refugee youth and families (Bhutanese, Burundian, Congolese, Somali, and Syrian)? and (2) What are the similarities and differences among these groups? We have fairly robust evidence contributing to our understanding of the importance of promoting STEM aspirations and college navigation among marginalized communities. By applying an SSCT lens, we have been able to demonstrate the influence of gender, race, and ethnic heritage on STEM education aspirations. We learned that the families involved in this research were generally committed to their children pursuing STEM careers. On top of the long-term economic benefit of increased access to STEM education for refugees and the communities they live in, a research study that centers refugee student and family perspectives on educational opportunities for STEM majors and career pursuits contributes a novel perspective for diversifying the scientific workforce and ameliorating educational inequities in the U.S. Considering this, it is clear that the families in the study have immense community and cultural wealth (Yosso 2005), which is often expressed through the nuances of culture, daily life, and social capital in all of these communities.

Implications for Scholarship and Practice

Need for Large-Scale University–EBCO Partnerships

Our study contributes to scholarly literature by describing the experiences and perceptions of refugee youth and their families. In doing so, our work highlights the educational inequities that refugee youth and their families face in the U.S. This is important because the refugee experience is understudied in STEM higher education research. Through our work, we have a better understanding of the development of STEM major/career aspirations, particularly among refugee youths and their families/communities. We found that the university–community organization program was effective in shaping STEM major and career aspirations for refugee youth and families. In many ways, the program served as a source and site for social and navigational capital (Yosso 2005). Students and families really value the experience of participating in enrichment academies and workshops, especially if they are well-designed. Additionally, the program's focus on STEM career development and aspirational goals solidified the intent among refugee youth to study STEM majors and become STEM professionals. By employing humor, indigenous knowledge, and collaborative processes, resettled refugee youth actively challenged the traditional understanding of science as inaccessible and created inclusive spaces for participation within a community-based STEM program.

Conceptual and Methodological Contributions

Methodologically, we also contribute to the literature via the use of a multi-ethnic, comparative research design. By comparing multiple ethnic groups in the same study, we have a better sense of commonalities and of behaviors that transcend ethnic/cultural heritage. This research design provides an opportunity for a diverse research group to leverage distinct types of expertise and their own experience, which is valuable for research. Moreover, it contributes to the existing scholarly literature on the choices of refugees and their experiences with STEM education and demonstrates the need for more effort to support the educational advancement of these communities, which will eventually lead to the improvement of society in general. Our study design helps tease out the most salient experiences of communities and see what other factors play a role in their aspirations. Specifically, by holding the refugee status constant, we are able to figure out some of the other dimensions of identity that are prominent in shaping postsecondary STEM aspirations. Among different families, we see that one major driving force for making sure the next generation of refugee students does better is the encouragement and support of parents. Families' aspirations for educational attainment and professional success are ideas that we see consistently expressed across the different groups in our study. This offers a potential way to integrate (not assimilate) newcomers into U.S. life, which is an experience that many groups—across race, ethnicity, gender, and language—seem to want. Additionally, our conceptual framework, SCCT, used to understand attributes influencing individual choices in career aspirations, is reaffirmed and extended by this study. Therefore, another contribution of our study to the literature that uses SCCT is the notion of how political

conflict and traumatic histories of migration shape aspirations for youth and families. Additionally, using a phenomenological approach helped capture the shared "cores" of educational and career aspirations across these communities despite their cultural, religious, and cultural differences and lifestyle.

Our work also has significance because it addresses the needs and trajectories of an understudied and marginalized group. Prior research suggests that refugee students may have specific psychological needs that continue to go unmet because of institutional resource and staff constraints (Jack et al. 2019). Our work suggests that students' broader community might serve to augment some of these psychological needs, so universities may consider building closer ties to ethnic and community-based organizations to facilitate STEM career accessibility. Moving forward, we recommend that college pipeline programs that work with immigrant students include families and community members (such as the ones described in this study) to ease the transition from secondary to higher education. This is especially important because the practical and cultural knowledge of immigrant people is often dismissed in collegiate settings. In other words, we advocate for higher education institutions to engage in large-scale partnerships with ECBOs. Cumulatively, institutional- and systems-level changes will undoubtedly lead to increased STEM aspirations and success for historically underrepresented populations.

Overall, engaging in a STEM-rich activity served as a powerful tool for refugee youth to uncover the complex nature of their community. Research projects, such as ours, reveal how social capital can be mobilized towards encouraging young people from minority ethnic backgrounds to pursue STEM careers. This process unveiled both the positive and negative dimensions of their community, intricately intertwined with the unpredictable nature of refugee rights. Yet, through this exploration, the youth were empowered to actively shape their community, forging their own path forward (Tan and Faircloth 2023).

Conclusion: The Need for Further Intersectional Research

In a call for intersectional analysis about refugee education, Unangst and Crea (2020) identify the tension between the interrogation of identity markers (for example, ethnicity) as essentialist, while still grappling with the need for systemic refugee support programs in higher education. Other scholars have also pointed out the tendency of postsecondary institutions to overgeneralize experiences of refugees in resettlement countries with perceptions of trauma and victimhood (Morrice 2013).

Our data reveal a similar tension: many of our participants, despite being the clear demographic outliers on national and regional scales, also resist essentialist notions of race and gender. Oftentimes, they resisted this classification all together (i.e., students from Family 2, 3, and 6). Keeping this tension in mind, we corroborate the recommendation from Unangst and Crea (2020), which called for a participatory approach to designing programs serving refugee students in higher education institutions in which refugee students themselves define and iteratively incorporate their own lived experiences and identities into university programs. Based on our study findings, we think this is especially important for participant recruitment. In our study, representatives of EBCOs were instrumental in recruiting families who ended up serving not just as participants in the broader enrichment program, but also who volunteered to be interviewees for this research. To continue moving this type of critical work forward, additional research that is cognizant of intersecting systems of oppression and multifaceted identities is needed.

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References

Abamosa, Juhar Yasin. 2021. Social Inclusion of Refugees into Higher Education: Policies and Practices of Universities in Norway. *Educational Review* 75: 1181–201. [CrossRef]

Aleaziz, Hamed. 2024. The U.S. Is Rebuilding a Legal Pathway for Refugees. The Election Could Change That. *The New York Times*. April 2. Available online: https://www.nytimes.com/2024/04/02/us/politics/legal-pathway-refugees-election.html (accessed on 11 October 2024).

Arizona State University. 2015. White House Recognizes ASU's American Dream Academy as 'Bright Spot'. *ASU News*. September 16. Available online: https://news.asu.edu/content/white-house-recognizes-asus-american-dream-academy-bright-spot (accessed on 21 October 2024).

Asad, Asad L. 2023. *Engage and Evade: How Latino Immigrant Families Manage Surveillance in Everyday Life*. Princeton: Princeton University Press.

Badrasawi, Kamal J. I., Iman Osman Ahmed, and Iyad M. Eid. 2018. Exploring Ways to Provide Education in Conflict Zones: Implementation and Challenges. *Intellectual Discourse* 26: 567–94. [CrossRef]

Baker, Sally. 2022. *People from Refugee and Asylum Seeking Backgrounds: An Open Access Annotated Bibliography*. Sydney: Refugee Education Special Interest Group.

Benish, Sarah. 2018. Meeting STEM Workforce Demands by Diversifying STEM. *Journal of Science Policy & Governance* 13: 1–6.

Berlin, Ira. 2010. The Changing Definition of African-American. *Smithsonian Magazine*. Available online: https://www.smithsonianmag.com/history/the-changing-definition-of-african-american-4905887/ (accessed on 11 October 2024).

Bernard, H. Russell, Gery W. Ryna, and Amber Y. Wutich. 2016. *Analyzing Qualitative Data: Systematic Approaches*, 2nd ed. Los Angeles: SAGE Publications.

Berryman, Mere, Suzanne SooHoo, Ann Nevin, Te Arani Barrett, Therese Ford, Debora Joy Nodelman, Norma Valenzuela, and Anna Wilson. 2013. Culturally Responsive Methodologies at Work in Education Settings. *International Journal for Researcher Development* 4: 102–16. [CrossRef]

Besteman, Catherine. 2016. *Making Refuge: Somali Bantu Refugees and Lewiston, Maine*, 1st ed. Durham: Duke University Press.

Boerchi, Diego. 2023. Reception Operators' Perception of the Labor Market Integration of Refugees in Light of the Social Cognitive Career Theory. *Social Sciences* 12: 19. [CrossRef]

Byars-Winston, Angela, Jenna Rogers, Janet Branchaw, Christine Pribbenow, Ryan Hanke, and Christine Pfund. 2016. New Measures Assessing Predictors of Academic Persistence for Historically Underrepresented Racial/Ethnic Undergraduates in Science. *CBE Life Sciences Education* 15: ar32. [CrossRef]

Byman, Daniel, and Sloane Speakman. 2016. The Syrian Refugee Crisis: Bad and Worse Options. *The Washington Quarterly* 39: 45–60. [CrossRef]

Cureton, Ashley, and Erick Aguinaldo. 2024. After High School, What's Next? Exploring Refugee Youths' Perceptions and Preparations Around College Choice and Transition. *Journal of Career Assessment* 32: 182–201. [CrossRef]

Çakir, Zehra, Sema Altun Yalçin, and Şeyma Günsel. 2022. The Effect of Engineering Design-Based STEM Activities on the Refugee Students' Sense of School Belonging. *Journal of Science Learning* 5: 478–87. [CrossRef]

Desikan, Anita, Jacob Carter, F. Abron Franklin, Raechel McKinley, Jennifer Orme-Zavaleta, Andrew A. Rosenberg, and Danielle Miller Wagner. 2023. *Strengthening and Diversifying the Federal STEM Workforce*. Cambridge: Union of Concerned Scientists.

Ennals, Richard. 2009. Jean McNiff and Jack Whitehead: Doing and Writing Action Research. *AI & Society* 24: 415–16. [CrossRef]

Flores, Glenda Marisol, Maricela Bañuelos, and Pheather R. Harris. 2023. "What are You Doing Here?": Examining Minoritized Undergraduate Student Experiences in STEM at a Minority Serving Institution. *Journal for STEM Education Research* 7: 181–204. [CrossRef]

Funk, Cary, and Kim Parker. 2018. *Diversity in the STEM Workforce Varies Widely across Jobs*. Washington, DC: Pew Research Center.

Gitau, Lydia Wanja, Achol Arop, and Caroline Lenette. 2023. 'My Dad Was, Is a Soldier': Using Collaborative Poetic Inquiry to Explore Intergenerational Trauma, Resilience, and Wellbeing in the Context of Forced Migration. *Social Sciences* 12: 455. [CrossRef]

Glaser, Barney, and Anselm Strauss. 2017. *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New York: Routledge.

Greif, Avner. 1994. Cultural Beliefs and the Organization of Society: A Historical and Theoretical Reflection on Collectivist and Individualist Societies. *The Journal of Political Economy* 102: 912–50. [CrossRef]

Hailu, Meseret F., Tebeje Molla, and A. T. Johnson. 2022. Researching experiences of African refugee youth in high-income countries: Reflections on conceptual challenges and possibilities. *International Journal of Intercultural Relations* 90: 168–76. [CrossRef]
Hofstede, Geert. 1998. Identifying Organizational Subcultures: An Empirical Approach. *Journal of Management Studies* 35: 1–12. [CrossRef]
Hutt, Michael. 2005. *Unbecoming Citizens: Culture, Nationhood, and the Flight of Refugees from Bhutan*. New Delhi: Oxford University Press.
Inda-Caro, Mercedes, Carmen Rodríguez-Menéndez, and José-Vicente Peña-Calvo. 2016. Spanish High School Students' Interests in Technology: Applying Social Cognitive Career Theory. *Journal of Career Development* 43: 291–307. [CrossRef]
Jack, Odette, Elaine Chase, and Ian Warwick. 2019. Higher Education as a Space for Promoting the Psychosocial Well-Being of Refugee Students. *Health Education Journal* 78: 51–66. [CrossRef]
Jones, Jason, Aaron Williams, Shanta Whitaker, Stephanie Yingling, Karen Inkelas, and John Gates. 2018. Call to Action: Data, Diversity, and STEM Education. *Change: The Magazine of Higher Learning* 50: 40–47. [CrossRef]
Judson, Eugene, Meseret F. Hailu, and Nalini Chhetri. 2024. Transformational Leadership Qualities of Effective Grassroots Refugee-Led Organizations. *Social Sciences* 13: 103. [CrossRef]
Judson, Eugene, Meseret Hailu, and Mohammed Ibrahim. 2023. Involving Parents and Community Leaders to Promote College and Career Aspirations among Refugee Youth. *Journal of Education and Culture Studies* 7: 66–82. [CrossRef]
Kalocsányiová, Erika, Natalia Bîlici, Ryan Jenkins, Maria Obojska, and Şahizer Samuk Carignani. 2022. What Works to Facilitate Displaced and Refugee-Background Students' Access and Participation in European Higher Education: Results from a Multilingual Systematic Review. *Educational Review* 76: 1722–43. [CrossRef]
Koyama, Jill. 2017. For Refugees, the Road to Employment in the United States Is Paved with Workable Uncertainties and Controversies. *Sociological Forum* 32: 501–21. [CrossRef]
Lent, Robert W., Steven D. Brown, and Gail Hackett. 2002. Social Cognitive Career Theory. In *Career Choice and Development*, 4th ed. Edited by Duane Brown. San Francisco: Jossey-Bass, pp. 255–311.
Lim, Boo Young, Myae Han, Shin Ae Han, Jiyeon Lee, and Vickie Lake. 2023. Refugees' Perspectives on Cultural Adaptation and Education of Their Children: Myanmar Refugee Mothers' Story. *International Journal of Higher Education* 12: 76–87. [CrossRef]
Lin, Chi Shiou. 2013. Revealing the 'Essence' of Things: Using Phenomenology in LIS Research. *Qualitative and Quantitative Methods in Libraries* 2: 469–78.
Lorenzi, Jane, and Jeanne Batalova. 2022. Sub-Saharan African Immigrants in the United States. Migration Policy Institute. Available online: https://www.migrationpolicy.org/article/sub-saharan-african-immigrants-united-states-2019 (accessed on 11 October 2024).
Makarova, Elena, Belinda Aeschlimann, and Walter Herzog. 2019. The Gender Gap in STEM Fields: The Impact of the Gender Stereotype of Math and Science on Secondary Students' Career Aspirations. *Frontiers in Education* 4: 60. [CrossRef]
Marshall, Catherine, and Gretchen B. Rossman. 2014. *Designing Qualitative Research*, 6th ed. Thousand Oaks: SAGE Publications.
Martin, Julie P., Renee Desing, and Maura Borrego. 2022. Positionality Statements are Just the Tip of the Iceberg: Moving Towards a Reflexive Process. *Journal of Women and Minorities in Science and Engineering* 28: v–vii. [CrossRef]
Međugorac, Vanja, Iva Šverko, and Toni Babarović. 2020. Careers in Sustainability: An Application of Social Cognitive Career Theory. *International Journal for Educational and Vocational Guidance* 20: 477–99. [CrossRef]
Morrice, Linda. 2013. Refugees in Higher Education: Boundaries of Belonging and Recognition, Stigma and Exclusion. *International Journal of Lifelong Education* 32: 652–68. [CrossRef]
Morrison, Jeana E., and Meseret F. Hailu. 2023. Black Women Abroad: Constructions of Gender, Race, Language, and Culture. *Journal of Women and Gender in Higher Education* 16: 137–57. [CrossRef]
National Immigrant Justice Center. 2021. A Timeline of the Trump Administration's Efforts to End Asylum. Available online: https://immigrantjustice.org/sites/default/files/content-type/issue/documents/2021-01/01-11-2021-asylumtimeline.pdf (accessed on 11 October 2024).
Okrent, Abigail, and Amy Burke. 2021. *The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers*; Alexandria: National Science Foundation. Available online: https://ncses.nsf.gov/pubs/nsb20212 (accessed on 21 October 2024).
Olson, Steve, and Donna Gerardi Riordan. 2012. *Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President*; Washington, DC: Executive Office of the President. Available online: https://files.eric.ed.gov/fulltext/ED541511.pdf (accessed on 21 October 2024).
Prasad, Rajesh, Carol Traynor, and Sara Smits Keeney. 2016. Hooking Them Young: Demystifying Computer Science and Technology among Underprivileged High School Students. Paper presented at 2016 IEEE Integrated STEM Education Conference (ISEC), Princeton, NJ, USA, March 5; Piscataway: IEEE, pp. 149–55. [CrossRef]
Pstross, Mikulas, Ariel Rodríguez, Richard C. Knopf, and Cody Morris Paris. 2016. Empowering Latino Parents to Transform the Education of Their Children. *Education and Urban Society* 48: 650–71. [CrossRef]
Qutoshi, Sadruddin Bahadur. 2018. Phenomenology: A Philosophy and Method of Inquiry. *Journal of Education and Educational Development* 5: 215–22. [CrossRef]
Refugee Processing Center. 2016. Admissions and Arrivals. Available online: https://www.wrapsnet.org/admissions-and-arrivals/ (accessed on 21 October 2024).

Rocha, Janet, Claudia M. Castillo-Lavergne, Marcus J. Byrd, Mercedes R. Carnethon, Rebecca Miller, Maria Lin, Erica E. Marsh, Janice K. Jackson, and Clyde W. Yancy. 2022. Reimagining Educational Equity through Strategic Alliance Partnerships in Response to the USA STEM-M Diversity Gap. *Health Promotion International* 37: daab094. [CrossRef] [PubMed]

Ryu, Minjung, Mavreen Rose S. Tuvilla, and Casey Elizabeth Wright. 2019. Resettled Burmese Refugee Youths' Identity Work in an Afterschool STEM Learning Setting. *Journal of Research in Childhood Education* 33: 84–97. [CrossRef]

Secules, Stephen, Cassandra McCall, Joel Alejandro Mejia, Chanel Beebe, Adam S. Masters, Matilde L. Sánchez-Peña, and Martina Svyantek. 2021. Positionality Practices and Dimensions of Impact on Equity Research: A Collaborative Inquiry and Call to the Community. *Journal of Engineering Education* 110: 19–43. [CrossRef]

Siddiky, Md Roknuzzaman, and Shahanaz Akter. 2021. The Students' Career Choice and Job Preparedness Strategies: A Social Environmental Perspective. *International Journal of Evaluation and Research in Education* 10: 421–31. [CrossRef]

Tan, Edna, and Beverly Faircloth. 2023. One World: Refugee Youth Incubating Epistemologies toward Rightful Presence with/in Community-Driven STEM. *Journal of Research in Science Teaching* 60: 1627–56. [CrossRef]

The White House. 2024. Fact Sheet: President Biden Announces New Actions to Secure the Border. Available online: https://www.whitehouse.gov/briefing-room/statements-releases/2024/06/04/fact-sheet-president-biden-announces-new-actions-to-secure-the-border/ (accessed on 11 October 2024).

Tuck, Eve, and W. Kayne Yang. 2014. R-Words: Refusing Research. In *Humanizing Research: Decolonizing Qualitative Inquiry with Youth and Communities*. Edited by Django Paris and Maisha T. Winn. Thousand Oaks: SAGE Publications, pp. 223–47.

Turner, Simon. 2004. Under the Gaze of the 'Big Nations': Refugees, Rumours and the International Community in Tanzania. *African Affairs* 103: 227–47. [CrossRef]

Turner, Simon. 2008. Cyberwars of Words: Expressing the Unspeakable in Burundi's Diaspora. *Journal of Ethnic and Migration Studies* 34: 1161–80. [CrossRef]

Unangst, Lisa, and Thomas M. Crea. 2020. Higher Education for Refugees: A Need for Intersectional Research. *Comparative Education Review* 64: 228–48. [CrossRef]

UNHCR (United Nations High Commissioner for Refugees). 2024a. *15by30 Roadmap: Expanding Higher Education, Skills and Self-Reliance for Refugees*. Geneva: United Nations High Commissioner for Refugees. Available online: https://www.unhcr.org/media/15by30-roadmap-expanding-higher-education-skills-and-self-reliance-refugees?utm_medium=email&utm_source=govdelivery (accessed on 21 October 2024).

UNHCR (United Nations High Commissioner for Refugees). 2024b. *Global Trends Report 2023*. Copenhagen: United Nations High Commissioner for Refugees Global Data Service. Available online: https://www.unhcr.org/global-trends-report-2023 (accessed on 21 October 2024).

Ward, Nicole, and Jeanne Batalova. 2023. *Refugees and Asylees in the United States*. Washington, DC: Migration Policy Institute. Available online: https://www.migrationpolicy.org/sites/default/files/publications/SPT-Refugees2023-PRINT-final.pdf (accessed on 11 October 2024).

Yosso, Tara J. 2005. Whose Culture Has Capital? A Critical Race Theory Discussion of Community Cultural Wealth. *Race Ethnicity and Education* 8: 69–91. [CrossRef]

Zhang, Liang, Xiangmin Liu, and Yitong Hu. 2024. Degrees of Return: Estimating Internal Rates of Return for College Majors Using Quantile Regression. *American Educational Research Journal* 61: 577–609. [CrossRef]

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