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Abstract

This instrumental case study (Stake, 1995) explores the external factors that influence international science, technology, engineering, and mathematics (STEM) postdoctoral scholars in the United States to pursue a career in STEM. Interviews with 20 international STEM postdoctoral scholars were analyzed deductively to shed light on their unique backgrounds and experiences. Three themes emerged: (a) parents were highly encouraging, (b) a love of science was nurtured in school, and (c) they were eager to engage in and promote scientific innovation. These findings illustrate the ways in which family, schools, and community influence the STEM career trajectories of international postdoctoral scholars.

Keywords

international postdoctoral scholars, STEM careers, career decisions

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"In My Blood": External Factors for International STEM Postdoctoral Scholars' Career Decisions

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Abstract

This instrumental case study (Stake, 1995) explores the external factors that influence international science, technology, engineering, and mathematics (STEM) postdoctoral scholars in the United States to pursue a career in STEM. Interviews with 20 international STEM postdoctoral scholars were analyzed deductively to shed light on their unique backgrounds and experiences. Three themes emerged: (a) parents were highly encouraging, (b) a love of science was nurtured in school, and (c) they were eager to engage in and promote scientific innovation. These findings illustrate the ways in which family, schools, and community influence the STEM career trajectories of international postdoctoral scholars.

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Introduction

The international community touts the importance of increasing the advanced science, technology, engineering, and math (STEM) workforce to strengthen the global economy and improve societal well-being worldwide (Freeman et al., 2019). To accomplish this, the U.S. imports its STEM talent to a large degree, resulting in international scholars holding over half of the STEM postdoctoral positions found in academia and governmental entities (Camacho & Rhoads, 2015). And yet, little research exists on the unique factors that directed their STEM career pursuits. Therefore, an instrumental case study design (Stake, 1995) is employed to explore the external factors that influenced U.S. international STEM postdoctoral scholars' career decisions. Interviews with 20 individuals were analyzed deductively with the key external factors influencing a person's career decision identified by Duffy and Dik (2009). The research question guiding this study was: What external factors influence international postdoctoral scholars in the U.S. to pursue a STEM career? This research was sponsored by the National Science Foundation Alliance for Graduate Education and the Professoriate.

Literature Review

In an effort to cultivate individuals prepared to enter the advanced STEM workforce in academia, industry, and government, postdoctoral positions in these fields have grown substantially over the last decade in the U.S. (Gordon et al., 2023). During a postdoctoral appointment, scholars develop critical labor skills while being further socialized into academic research (Hudson et al., 2018). Between 2002-2007, 45% of all Ph.D. recipients in the U.S. worked as postdoctoral scholars (Jaeger et al., 2019), and more than half of these positions in STEM fields were filled by international scholars (Lee et al., 2022). Though the number of international postdoctoral scholars in STEM has grown substantially in the U.S., little research is devoted to these scholars' unique experiences and career decisions.

Familial influences are widely recognized as a significant predictor of motivation to work in a STEM career (Abe & Chikoko, 2020; Craig et al., 2018; Haley et al., 2014; Hernandez et al., 2011; Ing, 2014; Mau et al., 2020; Sawitri et al., 2015; Šimunović & Babarović, 2021; Yerdelen et al., 2016). Research has revealed that parental encouragement in STEM directly influences children's mathematics achievement, which is positively related to pursuing a STEM career (Ing, 2014). In fact, parental support has a more significant influence on academic achievement across educational levels than that of teachers, counselors, friends, and other family members (Ing, 2014). When parents act as early academic motivators through encouragement, praise, and rewards, children experience increased intrinsic motivation and a deep sense of curiosity and fortitude when facing academic adversity (Ing, 2014). Additionally, parents outside the U.S. have reported encouraging their children to study in the U.S. due to a perception of a strong STEM research environment (Stephan et al., 2015).

While parental influence significantly predicts a child's achievement and persistence in STEM, familial individualistic and collectivist cultural differences can also play a role. Individualistic cultures are traditionally associated with Western societies, where ties between people and communities are loose (Mau et al., 2020). Thus, individuals are expected to care for themselves and only their immediate family. Sawitri et al. (2015) found that personal interests, self-efficacy, and career goals are more important predictors of a future career than family expectations in individualistic cultures. People raised in individualistic societies are more likely to be influenced by agentic goals such as skill mastery, achievement, status, and salary rather than parents and family (Abe & Chikoko, 2020; Fuesting et al., 2017; Yerdelen et al., 2016).

In contrast, collectivist cultures tend to foster individuals to act as a cohesive in-group, which provides protection and support for others in return for loyalty (Mau et al., 2020). Therefore, in collectivist societies, children are expected to accept unequal power distributions and follow the expectations set for them by their families—obedience is key, and children typically follow these expectations. For instance, Yerdelen et al. (2016) revealed that children in collectivist cultures may be expected to enter STEM fields to follow in their elders' footsteps. Thus, personal interests are much less significant to career trajectory than in individualistic cultures (Sawitri et al., 2015). Moreover, collectivist cultures report higher rates of communal goals over agentic goals as motivators for career selection (Fuesting et al., 2017). Zhou's (2015) study on international motivators to study or obtain postdoctoral positions in the U.S. showed that parents from collectivist cultures encourage their children to work in the U.S. for more prestige, career autonomy, and a better life.

Family socioeconomic status is another influence on an individual's career decisions. For example, Yerdelen et al. (2016) noted that parent income and education level are significant predictors of college selection, as well as math and science achievement. Moreover, socioeconomic status influences access to resources and experiences. Thus, some families or parents need not only access and resources but also awareness of STEM career opportunities to help direct their children to such career pursuits. With this knowledge, parents can guide their children to enter a specific field, particularly in technology-related areas (Scheitle & Ecklund, 2017; Yerdelen et al., 2016). Also, religion and spirituality can influence an individual's likelihood of entering a STEM field. Religious people are more likely to be discouraged from entering STEM careers, particularly physics and biology-related fields (Scheitel & Ecklund, 2017). The findings of Scheitel and Ecklund (2017) reflect that lower levels of interest in science and higher rates of belief in creationism mediate the religious influence on entering STEM careers.

The literature exploring the external factors that influence international STEM postdoctoral scholars in the U.S. to pursue a STEM career is an opportunity, as little research exists on this topic. As this population continues to grow in advanced STEM workforce roles globally, an understanding of the array of ways in which these scholars were motivated to enter a STEM career could help broaden participation efforts worldwide. Exploring these factors could provide a roadmap for identifying ways to further diversify and foster STEM interest at a young age across the globe. At the time of writing, no known studies have examined the unique formative experiences of U.S. international STEM postdoctoral scholars that led them to pursue a career in STEM. Therefore, this study aims to better understand how external influences influence career decisions at a young age.

Conceptual Framework

This study was guided by the conceptual framework of Duffy and Dik (2009), which identifies four external influences in the career development process (EICDP): family expectations and needs; life circumstances; spiritual and religious factors; and social service motivation. Conceptual frameworks are applied in qualitative inquiry to serve as a foundation of established knowledge, to offer logical explanations for the relationships observed, and to reveal nuanced understandings of a phenomenon (Anfara & Mertz, 2014). Thus, the EICDP was selected as the conceptual framework to ground the deductive coding protocol used during this study's data analysis phase and to serve as a channel by which to consider the implications of the findings. While Duffy and Dik (2009) acknowledged the literature focusing on internal influences, they highlighted the need for a conceptual framework that addresses the external factors influencing a person's career decisions. Thus, Duffy and Dik (2009) expanded upon work supported by volition-based influences (a person's degree of freedom of choice) on factors that sway individuals' career decisions.

According to Duffy and Dick (2009), family expectations and needs are considered the most significant external factors because family origin frequently relates to career aspirations, interests, perceived self-efficacy, feelings of support, and degree of volition. Naturally, the extent and form of family expectations and needs vary by culture and race. For example, in collectivist cultures, parents commonly select their children's career paths, and the child may experience guilt and shame if they diverge from the intended path (Duffy & Dik, 2009). Family expectations typically supersede the internal influences and desires of collectivist children. In Zhou's (2015) study,

international students reflected these sentiments by sharing that they carry their families' goals, pride, and dreams into their work. The second major factor in a person's career decision is life circumstances, which Duffy and Dik (2009) refer to as events that assist or hinder career development and advancement. Events influencing career development may include unexpected job opportunities, economic changes, balancing personal life roles, education structure, and local market conditions. Meanwhile, poverty, marginalization, and stigmatization may hinder career aspirations, as circumstances outside of meeting one's basic needs may seem unrealistic. Moreover, sudden changes such as job loss, sickness, market changes, natural disasters, and economic shifts can influence career aspirations and development (Duffy & Dik, 2009).

Third, spiritual and religious factors may influence a person's career aspirations (Duffy & Dik, 2009). An individual's spiritual and religious background can direct someone into a faith profession, or a career aligned with their moral compass and proclivities. This can include the ways in which factors such as a belief in creationism, evolution, or intelligent design drive career decisions. A study by Abe and Chikoko (2020) regarding STEM graduate student career decisions in South Africa noted that spirituality and morality are closely linked and provide direction and meaning in one's career choice. Finally, Duffy and Dik (2009) identified social service motivation as the fourth external factor influencing an individual's career development. This factor encompasses one's desire to improve the external world, such as following a calling to serve others with a desire to help the common good. Hernandez et al. (2011) expanded on this notion by indicating that many people select their jobs because they feel it is their *calling.* Furthermore, Zhou (2015) reported that international scholars were inspired to pursue a STEM career to give back to the scientific community.

Methods

Research Design

An instrumental case study (Stake, 1995) was utilized to explore the external factors that influenced international STEM postdoctoral scholars in the U.S. to pursue a STEM career. Instrumental case studies are valuable when illuminating a specific concern or problem within a setting that may be ambiguous to cursory observers. This inquiry utilized an instrumental case study to provide insight into an issue with understudied cases. Interviews conducted with 20 international STEM postdoctoral scholars were analyzed deductively with the EICDP conceptual framework (Duffy & Dik, 2009). The research question that guided this study was: What external factors influence international postdoctoral scholars in the U.S. to pursue a STEM career?

Participants

Fifty STEM postdoctoral scholars in the U.S. were recruited from the National Postdoctoral Association via an email alert; this inquiry analyzed the interviews of only the international STEM postdoctoral scholars. Participation was incentivized with a $25 e-gift card. The sample comprised a diverse group of 20 participants with equal numbers of individuals who self-identified as female and male. The ages ranged between 34 to 46 years. The postdoctoral scholars were from Brazil, Canada, China, Colombia, Cuba, France, India, Iran, Italy, Nigeria, Thailand, and New Zealand, which included a mix of collectivist and individualistic cultures yet are predominantly collectivist. All held temporary work visas, such as an H-1B visa, which permitted them to work in the U.S.

While some had spent time in the U.S. visiting and vacationing, no participants were raised in the U.S. General STEM disciplines included biochemistry, biology, chemistry, data science, engineering, environmental science, medicine, and neuroscience. A summary of participant demographics is listed in Table 1.

Table 1. Participant Demographics

Pseudonym	Gender	Age	Country	Culture	General Discipline*
Armando	Male	46	Colombia	Collectivist	Engineering
Angela	Female	35	Colombia	Collectivist	Engineering
Ajay	Male	Unknown	India	Collectivist	Data Science
Analia	Female	38	New Zealand	Individualistic	Biology
Abeo	Male	36	Canada	Individualistic	Engineering
Camila	Female	43	Italy	Collectivist	Engineering
Dahlia	Female	39	India	Collectivist	Chemistry
Eugene	Male	44	Colombia	Collectivist	Engineering
Eya	Female	34	Nigeria	Collectivist	Chemistry
Jade	Female	36	Thailand	Collectivist	Engineering
Jian	Male	34	China	Collectivist	Engineering
Luna	Female	38	France	Individualistic	Biology
Morgan	Female	35	Iran	Collectivist	Neuroscience
Naadir	Male	39	Iran	Collectivist	Engineering
Nadeesh	Male	35	India	Collectivist	Biology
Nandill	Male	42	India	Collectivist	Biochemistry
Suzanne	Female	34	Cuba	Collectivist	Biology
Sylvie	Female	38	Brazil	Collectivist	Medicine
Sanjay	Male	38	India	Collectivist	Environmental Science
Sudhir	Male	39	India	Collectivist	Medicine

Note. *General discipline is used to aid in masking the participants' identities.

Data Collection

Following Institutional Review Board approval, all participants were provided with a consent form detailing the purpose of the study, survey and interview procedures, and safeguards in place to protect their privacy and confidentiality. All interviews were conducted via Zoom or phone. Before the interviews commenced, participants completed an online, open-ended survey to gather their demographic information. A semi-structured interview protocol was created with pre-developed and open-ended probing questions for the researchers to seek clarification and meaning during the interview (Patton, 2015). Queries focused on participants' academic and personal backgrounds that led them to pursue a Ph.D. and postdoctoral position; experiences during their postdoctoral appointment; and their process in identifying their career goals. Interviews averaged 60 minutes in length. All participants were given pseudonyms, and de-identified participant interview transcripts were stored on a secured server accessible only to the research team. Sample questions relevant to this inquiry included:

- Talk to me about your childhood and any early education experiences that led you to pursue a career in STEM.
- Who in your life encouraged you to pursue a Ph.D., and why were they influential?
- What experiences make you feel as though you belong in a STEM career?
- What are your long-term career goals? How did you come to that decision?
- What are the most critical factors in determining your career path moving forward?

Reflexivity and Positionality

Throughout the study, the research team engaged in individual and collective reflexivity (Patton, 2015) by reflecting upon, bracketing out, and dialoguing about experiences, values, and beliefs concerning the external factors that motivate individuals to pursue a career in STEM. In qualitative research, reflexivity is a crucial component of inquiry, positioning researchers to consider their bias and its potential impact on meaning-making and interpretations during data analysis. Lincoln and Guba (1985) contended that researchers must disclose their positionality, so readers know the unique perspectives they bring to the study. The research team comprised social science American women trained in qualitative research methods within educational settings; one is a postdoctoral scholar, and the other is a professor. Both are engaged in STEM education research, particularly in efforts to diversify the engineering professoriate and broaden success in STEM academia, but neither holds a STEM degree.

Data Analysis

Stake's (1995) four-step deductive data analysis process of direct interpretation, categorical aggregation, pattern recognition, and naturalistic generalizations was utilized to analyze the interviews. Both researchers were engaged in all four steps of the data analysis process and frequently met to compare codes and themes to ensure inter-coder agreement. The EICDP conceptual framework (Duffy & Dik, 2009) was used to develop a deductive coding protocol focused on the four key external factors that influence a person's career decision: family expectations and needs; life circumstances; spiritual and religious factors; and social service motivation. Researchers first used the coding protocol to independently make direct interpretations of the interview data by determining the EICDP factors that emerged in the data. This process led to the identification of 23 distinct codes. In the second step, categorical aggregation was accomplished by collectively reviewing the nuanced codes identified in step one and categorizing the codes into five preliminary themes.

Using Stake's (1995) third step of pattern recognition, the researchers developed more precise codes by refining the grouping of associated data, developing fuse codes, and reconceptualizing the preliminary themes. This allowed the team to identify the external factors that influenced international STEM postdoctoral scholars to pursue STEM careers. This process resulted in three themes:

- Parents were highly encouraging.
- A love of science was nurtured in school.
- They were eager to engage in and promote scientific innovation.

In the last step, the themes were evaluated to assess their naturalistic generalization by ensuring the final themes represented the totality of the data and could be applied broadly to other contexts (Stake, 1995).

Trustworthiness

Multiple verification strategies were employed to ensure the findings were trustworthy by attending to credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Researchers utilized cross-case synthesis to address credibility, assessing whether themes were

similar or different among the participants' perspectives (Patton, 2015). Thick, rich descriptions with participant quotes aided in the transferability of the findings (Lincoln & Guba, 1985). The researchers' reflexivity and statement of positionality bolstered the findings' dependability by providing transparency about their backgrounds and experiences on this topic. Confirmability of the findings and conclusions was made possible by involving both researchers in using Stake's (1995) four-step deductive data analysis process and by providing several feedback loops to validate the themes (Patton, 2015).

Findings

Theme 1: Parents Were Highly Encouraging

All participants spoke highly of their parents' influence in encouraging them to succeed in school and promoting a STEM career pathway. Interestingly, nearly all had at least one parent in a STEM career, but few held a Ph.D. The parents of Abeo, (Canada) who is of Nigerian descent, worked in a local hospital. He noted, "A lot of my early childhood experiences… primed me in this direction… definitely a lot of expectation to go into medicine or some STEM career." Eya (Nigeria) remarked: "Everybody wanted their child to be a doctor… my dad decreed that I was going to go to medical school." Both Abeo and Eya initially planned to become medical doctors but became more interested in the research side of medicine while in college. Despite this career shift, each felt their parents supported their decision. Eya shared, "I owed it to my parents that whatever I was going to do, that I should do it to the best of my ability… and that's what kept me motivated."

Participants also indicated that a *culture of science* permeated their households. Sanjay (India), whose father is an engineer and sister is a medical doctor, stated, "There was a science focus in my family." Naadir (Iran) reported that his father is a university professor and noted, "I basically became familiar with the academic environment from childhood… he always expected me to get a terminal degree… it was kind of in my blood to just follow the path my father pursued." Similarly, Angela (Colombia) whose parents are engineering professors, shared, "I grew up very much at the university… I thought having a Ph.D. was normal… seeing the type of career my parents had influenced me to want to be a professor." Also, Ajay (India) said that having a father who is a medical doctor motivated him and normalized his pursuit of a college degree. Even those who did not come from a family of scientists and engineers shared that their parents "valued finding joy in school, which was a motivating factor to do well in science classes," as Suzanne (Cuba) described.

In all cases, the postdoctoral scholars shared that their parents equated an excellent education with having a good life. Sudhir, (India) stated:

> My mom and dad said, "Hey, you need to study hard… higher education is very important" … they made it clear that with a good education, you get more choices on the kind of career you can pursue and the life you will have.

Jade (Thailand) indicated that her father "never treated me as I'm a girl… I was raised up being rightfully independent… he didn't try to have me thinking to go get your master's and find a job and get married." Similarly, Dahlia (India) described her parents as encouraging her to do well in school as a means to overcome socioeconomic barriers. She remarked: "My parents are not really

that educated, but they were always encouraging me to do well in school and to learn more things so I could have a prestigious life." These sentiments were echoed by Jian (China), "My mom had almost no schooling, my dad finished high school. Grew up in China with two siblings. Mom valued education and pushed for education." Likewise, Nadeesh (India) commented, "I come from a poor family, but they did not ask me to go for a job, they asked me to just study and do well in school." The participant's parents inspired a love for learning and pursuing higher education, though notably, none of the participants from individualistic cultures spoke of a desire to fulfill familial wishes in their motivations for a STEM career.

Theme 2: A Love of Science Was Nurtured in School

While parents were the most pivotal influence on the postdoctoral scholars' pursuit of a STEM career, their early love of science also played an important role. Analia (New Zealand) said she "found school easy. I enjoyed learning and studying and doing science." These sentiments were echoed by Suzanne (Cuba) when she went on to state school helped foster her love of science; "my interest in science was really shaped in high school, I always found science very interesting." Moreover, Ajay (India) knew he could have a career in science when he realized he excelled in school: "I was having very good grades, I was my high school's topper, and I was liking my courses." Likewise, Luna (France) remarked:

> I really love science, and it was kind of easy for me to study biology… you have to have really good scores at school, you have to work really hard, you have to go to really selective schools to be a biologist.

Naadir (Iran) indicated he "was focused on just trying to be the best student… the initial success of passing the national exam with a good grade gave me the encouragement to pursue a career in engineering." The participants all shared unique experiences that further nurtured their love of science during their schooling. Participants reflected on positive experiences in school playing an essential role in developing their love of science.

This early love of science and success in school translated into unique experiences for the participants. Eugene (Colombia) noted that while in high school, he worked with a Colombian scientist who developed the first synthetic vaccine to treat malaria; he was able to "show teachers and classmates in high school [the scientist's] work, his procedures, his results." Suzanne (Cuba) said, "I've always been highly competent in science and science work which led me to receive scholarships and awards." Meanwhile, Dahlia (India) remarked her high school chemistry teacher recognized her strong academic performance and still serves as an important mentor in her life: "She's my role model, she keeps me motivated and encourages me to work hard." These formative STEM experiences, academic accolades, and relationships with those in STEM careers were vital to nurturing the postdoctoral scholars' early love of science.

Theme 3: Eager to Engage in and Promote Scientific Innovation

Encouragement from parents, a love for science, and an eagerness to engage in and promote scientific innovation led the postdoctoral scholars to pursue a STEM career. Nearly all discussed excitement about the possibility of real-world application of the STEM work in which they were involved. Nandill (India) discussed his interest in biotechnology, as it gave him the opportunity to be involved in cancer immunology research. He proudly spoke about "discovering a new monoclonal antibody which inhibits a toxic function in protein," which could have a major

influence in his field. Relative to her research on Parkinson's disease, Morgan (Iran) noted, "I want to get safe and efficacious treatments to the people who need them." Camila (Italy) summarized it for the participants by stating that the significance of "applying in practice what we are researching in academia" was a motivating factor to pursue a career in STEM.

The postdoctoral scholars also discussed the need for academics and researchers to better communicate science as a means of promoting STEM. Jian, (China) shared, "I want to be able to organize information better in my field and come up with a way to better explain it. I want it to be easier for people to access the field and all of the information within it." Some postdoctoral scholars expressed a desire to communicate science on a broad scale. This was of great importance to Angela (Colombia): "On my Instagram accounts, I have one in English and one in Spanish, I teach people about microbes… I've become really involved in these inclusive scientific communication communities, and it's something I want to continue pursuing." In comparison, Sanjay (India) added he became interested in environmental science after spending time with water activists in India; consequently, he plans "to join advocacy groups and nonprofit groups to better communicate the need for equitable water policies that benefit people and the environment." Luna (France) also shared a vision of communicating internationally when she shared her dream is to "connect with people globally… to help people that didn't know they could be connected."

Promoting scientific innovation and discovery by working with and inspiring students was stressed by nearly all participants. Sylvie (Brazil) said she was drawn to "an academic position where I could practice clinically and also do research and teach students." Sudhir (India) commented:

> I want to impart education to the upcoming generation because this is how you make them better. This is how you make them understand; "hey, like these are the troubled parts of science, and you need to work on this."

Eugene (Colombia) remarked, "I feel in some way inspired to teach about research, how to carry research out, and influence others about the importance of research." With a desire to extend his research even further, Armando (Colombia) expressed an interest in moving beyond benchwork and transitioning into operating a lab: "I want to take more leadership responsibilities and lead a team of student researchers by running a lab and helping them to be the best chemist or chemical engineer."

Meanwhile, some scholars were drawn to an academic lifestyle for the balance of mentoring, teaching, and research. For instance, Naadir (India) stated, "I would like to either become an assistant professor or join a national laboratory or a national agency to continue my research as just a scientist. So basically, doing research, it's ideal if I can also teach." Moreover, Eya (Nigeria) extended this excitement to promoting science through teaching:

> I like talking about my science… I enjoy teaching students. I enjoy intentionally opening their eyes to something that they haven't seen before… So, what I really think I want to do in my career is to accelerate this innovation.

Comparably, Suzanne (Cuba) noted, "The most appealing is the opportunity to mentor and pass on knowledge and experiences to students." Not only were participants excited about their science, but they were also excited about ways to disseminate their research and motivate future scholars. Participants declared one of their greatest joys was promoting scientific innovation with students.

Discussion

The purpose of this instrumental case study (Stake, 1995) was to explore the external factors that influenced international STEM postdoctoral scholars in the U.S. to pursue a career in STEM. The deductive analysis of the interviews was conducted through the lens of EICDP, as postulated by Duffy and Dik (2009). While a small body of literature exists regarding external influences on STEM postdoctoral scholar career trajectories (Craig et al., 2018; Ing, 2014; Jaeger et al., 2019), this is the first study to explicitly examine the career decisions of international STEM postdoctoral scholars in the U.S. The findings of this study revealed three key themes. First, participants spoke of having highly encouraging parents; second, participants' love of science was nurtured in school; and third, participants noted they were driven to a STEM career because they were eager to engage in and promote scientific innovation. These findings expand upon the sparse literature on this topic (Craig et al., 2018; Ing, 2014; Jaeger et al., 2019).

Notably, nearly all participants had at least one college-educated parent in a STEM career, and parents were the primary encouragers to pursue a STEM career. As Hudson et al. (2018) noted, STEM careers are considered prestigious and secure, and parents of international postdoctoral scholars reiterated these descriptors to their children. Most indicated that a STEM career would either improve or maintain their standard of living, which connects to the research of others (Craig et al., 2018; Ing, 2014; Scheitle & Ecklund, 2017; Stephen et al., 2015; Zhou, 2015). Interestingly, most participants came from collectivist cultures; thus, they were more likely to follow their parents' career advice and wishes (Abe & Chikoko, 2020; Fuesting et al., 2017; Mau et al., 2020; Yerdelen et al., 2016). While some veered from the specific career their parents had hoped for them, such as becoming a medical doctor rather than a medical researcher, they felt their parents ultimately wanted them to pursue a career of their choice. Thus, participants closely fulfilled their parents' expectations by blending them with their own career passions. The findings also indicated that those from collectivist cultures, such as Columbia, India, and Nigeria, were inspired to follow in their parents' career footsteps, echoing the findings of other researchers (Fuesting et al., 2017; Mau et al., 2020; Sawitri et al., 2015; Yerdelen et al., 2016). However, those from individualistic cultures, such as France and New Zealand, were more likely to choose a STEM career due to their personal interest and strong self-efficacy for science. Nevertheless, nearly all spoke of a STEM career as a *calling*, as described by Hernandez et al. (2011), and as a way to give back to the scientific community (Zhou, 2015).

The findings of this study closely align with the conceptual framework of EICDP postulated by Duffy and Dik (2009). The first theme, parents were highly encouraging, closely connected with the first factor of the EICDP, and family expectations and needs. For instance, participants discussed having parents in STEM who encouraged them to follow suit or had parents who viewed STEM careers as offering a good lifestyle and encouraged their children to seek out these career fields. The second theme, a love of science that was nurtured in school, corresponds with the second factor of life circumstances. For instance, the participants spoke about the development of a science identity and the ways in which that identity was nurtured through academic accolades and by teachers. The third theme, eagerness to engage in and promote scientific innovation, relates to factor four, social service motivation. Participants noted the desire to apply their research to the real world, better communicate science to others, and inspire students to pursue STEM research, thus positioning their actions as social services.

Theoretical Implications

The data analysis yielded no findings identifying religion or spirituality as a significant factor in international STEM postdoctoral career decisions. This finding could be because the interviewers did not specifically probe for religious or spiritual influence, as that was not the focus of the larger study. Participants may not have been forthcoming on this area of potential influence since it can be considered taboo or sensitive to explore outside one's family or cultural context.

Practical Implications

This study's findings illustrate the ways in which family, schools, and community influence the STEM career trajectories of international postdoctoral scholars in the U.S. This knowledge base can be valuable when recruiting and retaining them in the STEM workforce. For instance, knowing they are attracted to STEM because of an eagerness to engage in and promote scientific innovation with students could suggest academic positions that encompass the opportunity to mentor students in research may be highly attractive.

The identified external factors also could be particularly instructive to primary and secondary school teachers and administrators as they engage parents, especially in collectivist cultures, on the career aspirations they hold for their children, strengthen students' love of science, and ground curriculum in local community needs to foster an early interest in STEM. Moreover, these identified factors should be championed in schools and educator preparation programs to help encourage students to engage with STEM. Additionally, these experiences also improve student self-efficacy, which would further support students from individualistic backgrounds.

Future Research

Future exploration of this topic using the EICDP postulated by Duffy and Dik (2009) is warranted, as scant literature is devoted to this topic with international STEM postdoctoral scholars in mind. Possessing a greater understanding of the external factors that drive STEM career trajectories from a young age can be fruitful in efforts to broaden STEM participation. This is particularly true as it relates to gender since women remain underrepresented in the STEM workforce worldwide (Miller & Riley, 2021), understanding external factors that promote their STEM participation could prove enlightening. Also, a more directed inquiry into exploring religious and spiritual motivations to pursue STEM careers could be valuable, as well as how collectivist and individualistic cultures promote STEM careers. While the literature is vibrant on the role of parents and families in encouraging STEM careers, less is known about how a love of science is nurtured and individuals are drawn to engage in and promote science innovation.

Limitations

As in all research inquiries, this study has several limitations. First, the research team did not conduct member checks because arranging and conducting interviews was difficult due to participants' demanding schedules. Member checking might have provided more complex and nuanced depictions of the external factors that influenced participants to pursue a STEM career. While the study exposed researcher bias through reflexivity and positionality, its potential to influence the findings and interpretations cannot be guaranteed. Last, this inquiry is primarily

approached from an outsider's vantage point, as the researchers are of American descent, have not worked abroad, and do not hold a STEM academic background.

Conclusions

As the number of international STEM postdoctoral scholars in the U.S. increases, it is vital to understand the external factors that influence them to pursue a STEM career. This instrumental case study (Stake, 1995) provides the first known exploration in this area. Through a deductive analysis, findings indicate three primary external factors exist: parents were highly encouraging; a love of science was nurtured in school; and they were eager to engage in and promote scientific innovation. This study provides unique insights from participants not born or raised in the U.S., which strengthens the understanding of the career motivations of advanced, international STEM professionals working in the U.S. These insights highlight the ways in which families, schools, and communities foster, promote, and motivate students toward working in STEM.

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