Towards a Better Understanding of the Experiences of FB/FT STEM Faculty: A Systematic Review and Qualitative Metasynthesis of the Literature through Intersectional Lenses of Gender and Race/Ethnicity

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This study proposes to provide a systematic review and qualitative meta-synthesis of the literature to explore the similarities and differences in academic workplace experiences between the Foreign Born/Foreign Trained (FB/FT) and other groups of Science, Technology, Engineering, and Mathematics (STEM) faculty using intersectional lenses of gender and race/ethnicity.

Although a burgeoning literature, propelled partially by NSF programs such as ADVANCE (e.g. Gold et al., 2022; Rosser & Laursen, 2022; Zippel & Ferree, 2019) has focused on gender in STEM faculty, most studies do not consider the FB status of the faculty, while those that study trajectories of FB faculty do not focus on gendered experience; this results in FB women STEM faculty being overlooked and understudied. While data on international students are publicly available (e.g., ASEE, 2020; NSB-NSF, 2021), collecting data for faculty becomes very difficult because of privacy issues and rapid changes in residency status; most university employers only track FB status of the faculty for visa purposes, without linking it to any internal assessments as they do with gender and URM status. A small number of researchers (e.g., Akulli, 2015; Foote, et al., 2008; Rita & Karides, 2021; Wells, 2007) have studied the issues related to FB faculty in STEM.

While overall trends in recruiting and retaining more faculty who identify as women in STEM departments are promising, demographic markers such as URM status need to be carefully studied, especially with regard to FB status. NSB-NSF (2021) documents that the number of foreign students with doctoral degrees in STEM has been consistently increasing for almost two decades and hiring FB women in academia has also increased simultaneously. Most of these foreign nationals are eventually naturalized and become citizens. While the immigration status of these faculty is transitional, their specific cultural and racial identity carries forward.

Unfortunately, the classification of these individuals in URM/Non-URM status is complicated (Rita & Karides, 2021), as 1) the URM definition used by NSF is based on underrepresentation in STEM fields relative to the overall U.S. population, but FB faculty are drawn from the world population where the ethnic groups adversely affected by systemic inequities may or may not align with the U.S. definitions; 2) FB faculty of Black and Hispanic backgrounds are included in URM, which raises the number of URM faculty but does not reflect an improvement in the including of historically underrepresented African American and Hispanic populations in the U.S.; 3) FB faculty of White and Asian backgrounds are not included in URM because they are not underrepresented in STEM relative to their proportion in the U.S. (although White and Asian women are underrepresented in some STEM fields), but many are still minorities in the education system and thus experience cultural isolation. Also, their experiences with bias are obscured when combined with USB non-URM experiences; "Asian" is an overly broad category that as a whole is overrepresented in STEM fields, but considering it as an aggregate masks pockets of under-represented USB minorities (e.g., Hmong, Vietnamese); and White aggregates European, North African, and Middle Eastern, making it difficult to distinguish the biases individuals from these different regions face. Furthermore, the definitions of whether Asians, who form the largest pool of PhD awardees in some STEM areas (e.g., engineering) are considered a racial minority vary between the NSF and U.S. Census Bureau, creating major gaps in understanding the demographic data on faculty in the professoriate.

Methods

Choice of Meta-synthesis

I chose meta-synthesis rather than meta-analysis for this study for several reasons 1) Many of the international students receiving PhDs become the academic faculty of STEM

departments; most of these foreign nationals are eventually naturalized and become citizens, such that they can no longer be tracked over time as FB/FT. Thus, quantitative data on FB/FT faculty are difficult to obtain and unreliable, suggesting that qualitative data would likely yield more information on the experiences of these faculty; 2) Preliminary searches indicated that literature on FB/FT faculty is relatively limited but robust enough to identify additional themes and gaps; 3) Meta-synthesis allows the systematic review and integration of findings from qualitative studies of smaller numbers; 4) Meta-synthesis permits the use of "gray literature," including dissertations and non-peer reviewed materials such as professional society newsletters where information on experiences of FB/FT STEM faculty sometimes is published.

Data bases, key words and criteria

Initial databases. The initial databases searched included the following: Springer, Wiley, Web of Science, Sociological Abstracts, Women's Studies International, Race Relations Abstracts, Proquest and Theses Global; as well as databases from professional societies such as American Chemical Society (ACS), American Physical Society (APS), American Mathematical Society (AMS), American Society for Engineering Education (ASEE), and Association for Computing Machinery (ACM).

Initial keywords. Initial keywords focused on the following four fields 1) foreign born or international, combined with 2) STEM faculty, combined with 3) gender or women, combined with 4) URM or race/ethnicity.

Criteria. Initial inclusion criteria were the following a) published between 2001—2021; b) included qualitative data; c) published in English; d) utilized a U.S.-based sample in U.S. higher education institutions; e) included STEM faculty; f) included peer reviewed articles or books, dissertations, conference presentations, and publications of professional societies.

Initial exclusion criteria were as follows a) FB or international faculty in medical schools; b) FB researchers at universities who are not defined as faculty; c) FB researchers outside of academic institutions (i.e., employed by corporations or government).

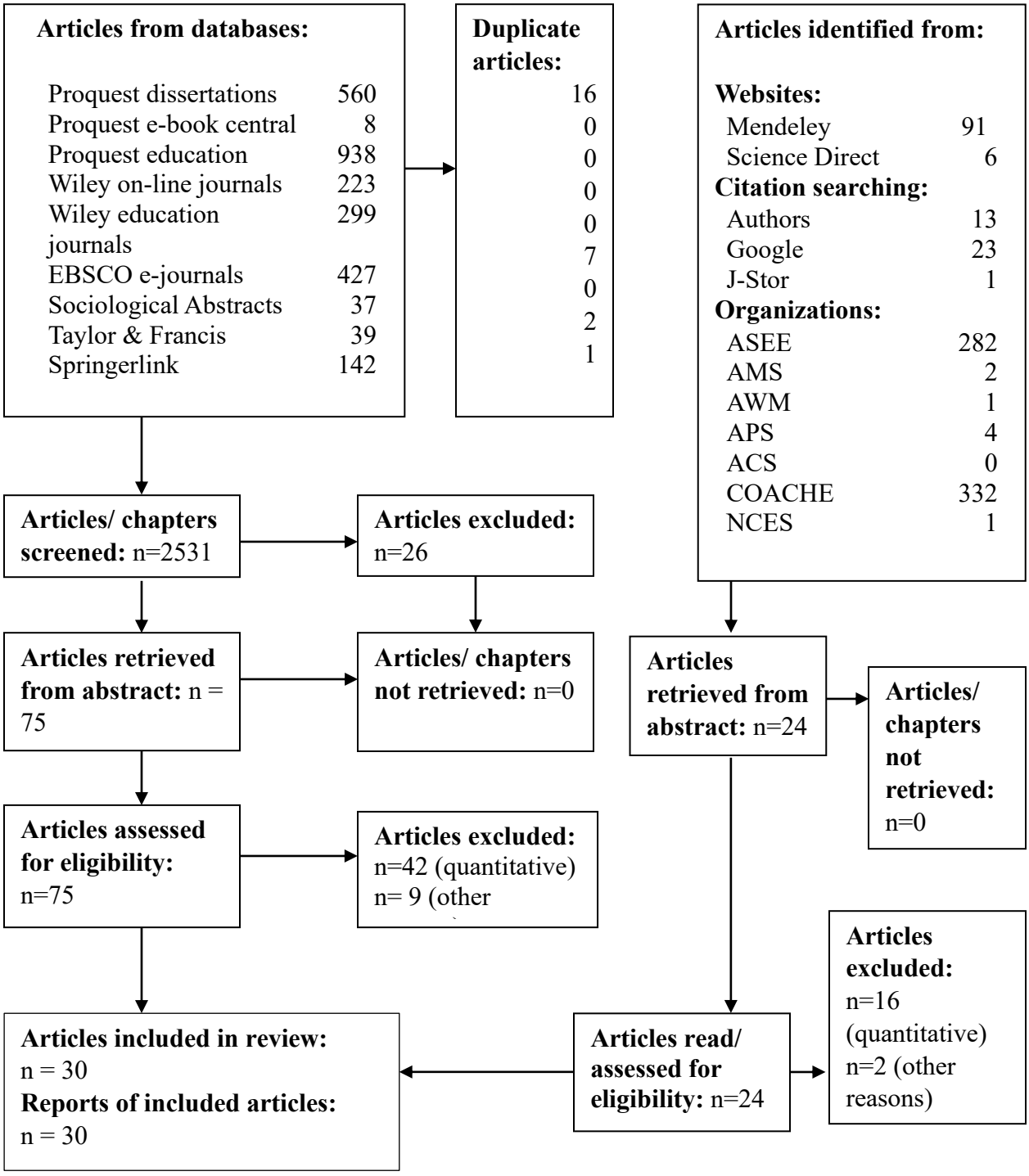
Results

Although all of the initial databases in the proposal were searched, Springer, Wiley, Proquest and Proquest Theses Global, and Sociological Abstracts were most useful. The databases from professional societies yielded minimal articles. I had not anticipated that much of the useful literature was published in journals and books focused on higher education. Thus, Taylor and Francis books and journals, as well as EBSCO e-journals proved to be useful additions to databases searched, along with Proquest education and Wiley education databases.

Applying all initial four keyword fields in combination yielded no or one to two results in virtually all searches. The fourth field of URM or race/ethnicity was especially problematic, as most of the research on FB faculty lumps all races/ethnicities together. In some instances, race/ethnicity is treated as a variable, but it is not then intersected with gender or FB status in analyses. Some of the included qualitative studies focus only on experiences of FB women faculty from one race/ethnicity, such as Asian women in STEM, but their experiences are not compared to experiences of USB women or of FB men in STEM. All studies in the final metasynthesis included the initial three keyword fields of FB, STEM, and gender.

Figure 1.

PRISMA Diagram of Databases, Websites, Organizations and Citations Searched



Initial searches yielded 3,287 articles, chapters, or other literature from databases (2,531), and other sources such as websites, organizations, and citation searches (756) possibly relevant to experiences of FB/FT women faculty in STEM. Removing duplicates and applying most of the initial inclusion/exclusion criteria led to 99 articles, 75 from databases and 24 from other sources, to be assessed for inclusion in the review. Forty-one of these articles that used qualitative or mixed methods were assessed further for determination of whether they merited inclusion in the final review; the other 58 used quantitative methods and were not included in the final metasynthesis, except as background materials.

For the initial searches that yielded the 99 articles that I downloaded and read, I applied all of the initial inclusion/exclusion criteria with the exception of b) includes qualitative data, based upon advice that literature based on quantitative methods could be used to direct towards themes in the qualitative research. The 99 articles include 58 such quantitative articles, used in developing the themes and subthemes, but not in the final metasynthesis.

Thirty qualitative or mixed methods articles were ultimately included. Eleven were eliminated for these reasons: Five, because upon closer analysis, it was clear they were not STEM faculty; one turned out to really be quantitative upon closer analysis; one only included Black African men, with no comparisons to women; one was not really FB, nor was it intersectional; one was not U.S.-based; one focused on Puerto Ricans in Puerto Rico, so did not really include FB. One did not separate USB and FB results.

Closer reading of each of the 30 articles allowed me to select themes through an iterative process of categorization and analysis of the content (Cooper, 2015; Finfgeld-Connett, 2018). It permitted the charting of articles based upon the following categories: type of publication, year

published, peer review status; type of institution studied; method used in study (mixed or purely qualitative); disciplinary fields; primary discipline; foreign born; gender (see Table 1, below).

Table 1.

Charting of Articles Based on Categories

1st Auth	Pub + yr	Peer	Type Org	Method	Field	Prim. Disc.	For. Born	Gender
Abla	Diss. 2012	Committee	R-1,2, MA	Qual-Inter	Multiple	STEM +	Yes	Both
Afoaku	Diss. 2015	Committee	PWI+HBC	Qual-Inter	Multiple	2/8 STEM	Yes	Women
Agrawal	Diss. 2014	Committee	R-1	Qual-Inter	Multiple	1/8 STEM	Yes	Women
Alberts	2008	Yes	R-1,o.uni	Mixed	Geo-graphy	Geography	Yes	Both
Boafo-Arthur	2021	Yes--chapter	not spec	Rev. Art	Multiple	Not esp STEM	Yes	Both
Canargarajah	2018	Yes	R-1	Qual-Inter	Multiple	All STEM	Yes-Chin	Both
Carrattini	Diss. 2015	Committee	R-1	Qual-Inter	Multiple	STEM +	Yes	Both
Carrattini	2013	Maybe	R-1	Qual-Inter	Multiple	STEM +	Yes	Both
Chena	2018	Yes	not spec	Qual-Inter	Multiple	Not esp STEM	Yes	Women
Ghosh	Diss. 2015	Committee	R-1	Qual-Inter	Multiple	STEM +	Yes	Both
Ghosh	2021	Yes	R-1	Qual-Inter	Multiple	STEM +	Yes	Both
Goodroad	Diss. 2019	Committee	2 year	Qual-Inter	Multiple	Not esp STEM	Yes	Both
Hernandez	2019	Yes--chapter	not spec	Rev. Art	Multiple		Yes	Both
Howe	Diss. 2011	Committee	R-1	Qual-Inter	Multiple	6/11 STEM	Yes	Both
Lawless	2017	Yes	not spec	Qual-Inter	Multiple	Not esp STEM	Yes	Women
Lightner-Noll	Diss. 2021	Committee	R-1, R-2	Qual-Inter	Multiple	All STEM	Yes	Women
Ochukpue	Diss. 2004	Committee	HBCU	Qual-Inter	Multiple	6/8 STE<	Yes	Both
Roy	Diss 2019	Committee	R-1--CC	Qual-Inter	Multiple	STEM + HUM	Yes	Women
Sharma	2021	Yes	Univ.	Qual-Inter	Multiple	All STEM	Yes	Both
Skachkova	2007	Yes	R-1	Qual-Inter	Multiple	STEM +	Yes	Women

Switzer	Diss. 2012	Committee	R-2	Qual-Inter	Multiple	8/11 STEM	Yes	Both
Theobold	2009	Yes	all types	Mixed	Geography	Geography	Yes	Both
Veliz	Diss. 2014	Committee	R-2	Qual-Inter	Multiple	9/12 STEM	Yes	Women
Veliz	2019	Yes	R-2	Qual-Inter	Multiple	9/12 STEM	Yes	Women
Wei	Diss. 2007	Committee	R-1	Qual-Inter	Multiple	STEM +	Yes	Both
Wittenstein	2020	Yes	All types	Qual-Inter	Multiple	Not STEM	Yes	Women
Xue	Diss. 2016	Committee	R-2	Qual-Inter	Multiple	Most STEM	Yes	Both
Yakaboski	2016	Yes	R-1	Qual-Inter	Multiple	All STEM	Yes	Women
Young	Diss. 2012	Committee	All types	Mixed	Mech. Eng	ME only	Yes	Both
Zanin-Yost	Diss. 2020	Committee	Pub. Univ	Qual-Inter	Multiple	5/11 STEM	Yes	Both

Note: "1st Author" means sole or first author of multi-authored publications; "Pub + year" indicates whether the publication was a dissertation or other type of publication and the year that it was published; "peer" means whether or not the publication was peer reviewed (in the case of dissertations, the committee reviewed); "type org" denotes whether the institution of focus was a research 1 or 2 (R-1 or R-2), Historically Black College or University (HBCU), identified as Primarily White Institution (PWI), two year or public institution; "method" indicates whether the authors used qualitative research with interviews, mixed methods, or wrote a review article; "field" indicates the discipline focused on in the publication; "primary disciplines" indicates the major focus of the publication; "FB" denotes a major focus on foreign born faculty; and "gender" indicates whether men, women or both were discussed.

Careful reading of each of the 30 articles and use of the keywords allowed charting of several themes: FB vs. USB compared, gender of subjects studied, FB male vs. FB female compared, FB female vs. USB female compared, race/URM, workload issues of teaching (with language as a subset), research, and service; immigration issues; pull of country of origin vs. U.S. (see Table 2, below).

Table 2.

Charting of Articles Based on Themes

							Workload issues			**Immigration**	**Pull of origin vs US**	
1st auth	**FB vs USB**	**Gender**	**M vs F**	**F vs F**	**Race/ URM**	**Teaching**	**Language**	**Research**	**Service**		**Orig fam**	**Integ. US**
Abla	No	Both	No	No	Yes	Some	For some	Compete	Minor			
Afoaku		Women	N/A	Yes	Yes	Some	For some	Publish	Leadership	Transition	Int.travel	Af. Amer
Agrawal	Yes	Women	N/A	Yes	Yes	Some	For some	Focus	N/A			
Alberts	No	Both	No	No	No	Focus	Focus	N/A	N/A	N/A	N/A	
Boafo-Arthur	Yes	Both	Yes	Yes	Yes	Some	For some	Some	Some	N/A	Some	
Canargarajah	No	Both	Yes	No	Yes-Chin	Minor	Focus	Focus	N/A	N/A	N/A	
Carrattini	Yes	Both	Yes	Yes	Yes	Some	For some	Some	Some	Some	Yes, both ways	
Carrattini	Yes	Both	Yes	Yes	Yes	Some	Some	Some	Some	Some	Yes, both ways	
Chena	Yes	Women	Yes	Yes	Yes	Some	Yes	N/A	N/A	Yes	Some	
Ghosh	Yes	Both	Yes	Yes	Yes	Some	Yes	Some	Some	Yes	Some	
Ghosh	Yes	Both	Yes	Yes	Yes	Some	Yes	Some	Yes	Yes	Some	
Goodroad	No	Both	Yes	No	Not really	Some	Yes	Minor	Some	Yes	Some	
Hernandez	Yes	Both	Yes	No	Yes	Minor	Yes	Minor	Minor	Yes	N/A	
Howe	No	Both	No	No	No	Some	Yes	Major	Some	Yes	Yes, both ways	
Lawless	Yes	Women	Yes	Yes	Yes	Some	Yes	Yes	Yes	Yes	Some	
Lightner-Noll	No	Women	N/A	No	Asian only	Some	Yes	Yes	Yes	N/A	Some	

Ochukpue	No	Both	Yes	No	Af. Am/Af	Some	Yes	Yes	Yes	N/A	Yes, both ways	
Roy	Yes	Women	N/A	Yes	As.Am /As	Some	Minor	Some	Focus	Some	Some	
Sharma	No	Both	No	No	Not really	Yes	Focus	Some	N/A	N/A	N/A	
Skachkova	Yes	Women	N/A	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes, both ways	
Switzer	No	Both	No	No	Yes	Yes	Yes	Yes	N/A	Yes	N/A	
Theobold	Yes	Both	Yes?	Yes	Not really	Yes	Yes	Yes	Yes	Yes	Yes, both ways	
Veliz	Yes	Women	N/A	Yes	Not really	Yes	Yes	Yes	N/A	Yes	N/A	
Veliz	Yes	Women	N/A	Yes	Not really	Yes	Yes	Yes	N/A	Yes	N/A	
Wei	No	Both	Yes	No	Not really	Some	Yes	Yes	Minor	N/A	Yes, both ways	
Wittenstein	No	Women	N/A	No	Yes	Some	N/A	Yes	Yes	N/A	Yes, both ways	
Xue	No	Both	No	No	Somew hat	Yes	Yes	Yes	Yes	N/A	Yes, both ways	
Yakaboski	No	Women	N/A	No	Asian only	No	No	Some	N/A	N/A	Focus dual career	
Young	Sort of	Both	Yes	No	Not really	Yes	No	Yes	Yes	N/A	N/A	
Zanin-Yost	No	Both	No	No	Not really	Yes	Focus	Yes	Yes	Some	N/A	

Note. 1st author means first author of sole or multi-authored publications; FB vs USB means foreign born compared to U.S. born discussed in publication; gender means men, women, and/or both are discussed; M vs F indicates comparison of males and females; F vs F indicates comparison of FB females with USB females; Race/URM means whether or not race or underrepresented minority status is considered; under Workload Issues, teaching, language difficulties, research, or service are each noted separately, as to whether they are discussed in the publication; immigration indicates whether or not immigration status/issues are discussed; pull of origin vs. U.S. indicates whether the pull of the country of origin compared to integration into U.S. culture of foreign born faculty is discussed in the publication.

I also used the keywords and similar charting to aid in developing the themes. For example, subthemes within workload include the following a) teaching, with further subthemes of language issues, production of student credit hours, student discrimination, evaluations, b) research, with further subthemes of difficulties of obtaining collaborations and visibility for women, ineligibility for some funding due to immigration status, c) service with subthemes such as different, less important committee assignments, difficulties obtaining leadership positions, and stereotypical gender role and cultural expectations for FB women for service. Subthemes emerged for each of the other five findings and are reflected in the quotations below from the articles included in the study.

Findings

Although the qualitative studies provide rich examples of issues facing FB women faculty, particularly women of color, these vary considerably, depending upon the country of origin of the individual and her immigration path to the United States. Six overarching findings emerge from the literature, described briefly below using exemplary quotations from the qualitative literature of each finding.

Different experiences of FB women

FB women appear to have different experiences compared to FB men and to USB women and men. Depending upon their race/ethnicity, FB women faculty often experience the double bind of racism and sexism, which when combined with the discrimination that sometimes accompanies FB status, results in a triple bind. A Black African faculty member at a primarily White institution (PWI) stated:

> I encountered a lot of challenges when I first started. I spoke a slightly different accent coming from Africa! Students appeared disinterested when they started the class.

> Students later were amazed about where I gained knowledge in chemistry because the image of Africa they have come to know is a poor struggling country with her nationals killing one another. I had to explain several times that Africa is a continent of 54 countries. (Boafu-Arthur, 2021, p.4)

The students seemed to be particularly amazed at a chemistry professor who defied their expectations of race by being black, of gender by being a woman, and by coming from a continent that the students seem to view as inferior to North America.

Another immigrant woman professor of color, Xue Lang Rong (2002), agrees that "when we depend upon colleagues' kindness and humanity alone, minority women faculty succeed only by chance" (Skachkova, 2007, p. 717).

The above quotation indicates that faculty, as well as students, perpetuate the triple bind FB women academics experience. Both USB faculty and students may have stereotypical expectations for women from certain cultures; for example, expecting women from some Asian cultures to be deferent and dress in particular ways.

Some FB women have found that if FB men from their country of origin are also in their department or college, the FB men may treat them differently than they do USB women, based upon gender and/or religious expectations for women in their country of origin. For example, FB men may seek research collaborations with both USB and FB men, including from their country of origin, and even with USB women colleagues. The literature provides little explanation for this differential treatment other than to mention it results in FB women not being included in networks for research collaboration in which FB men and USB women and men participate. The implication is that FB Muslim men, for example, may exclude FB Muslim women colleagues because of religious beliefs and prior gender segregation in education. An additional implication

is that USB women colleagues are presumed to be exempt from gender expectations practiced in the country of origin.

Those FB women in STEM who initially enter the U.S. via their husband, face particular career advancement barriers. An Indian physics associate professor said: “A lot of women marry people senior to them. So, [if] he’s more advanced in his career than she is, then she falls farther and farther behind because his professorship is always more important than her assistant professorship” (Yakaboski, 2016, p. 76).

Differential workload assignments for FB faculty

FB faculty tend to have different workload assignments than USB faculty. Many studies, particularly in the quantitative literature (Corley & Sabharwal, 2007; Mamiseishvili & Rosser, 2010) have documented that FB faculty, both women and men, tend to be more productive in research than USB faculty, as measured by peer-reviewed articles, books, and other scholarly publications. Indeed, many FB STEM faculty are hired initially because they hold a proven track record of publications or experience in industry. Perhaps for this reason, FB faculty have workloads that reflect more time devoted to research and less to teaching and service in institutions that allow differential workload assignments.

Simultaneously, because FB faculty are not eligible to apply for certain grants until they become citizens or permanent residents, their research productivity may be inhibited. Denise, an assistant professor in the STEM fields, stated as follows:

> Being international has been a challenge because it prevents you from being able to apply for different grants. It is hard because you can have your good research to win that award but, without that paperwork, you can’t apply for them. So, for my career, I have missed quite a few opportunities because of that status. (Veliz, 2019, p. 12)

However, unlike universities and institutes in some countries, expectations for promotion, tenure, and advancement at most U.S. institutions include factors beyond research productivity, as the following quotation indicates. A Chinese STEM woman faculty said:

> To get tenured, it is not only just getting your research funded and published, there are other things like visibility and leadership. All these kinds of things you need to start to consider; then I think it's all the cultural differences that start to kick in. . . . there is a lot of human interaction, your interaction with your chair, with your peers so that started to show like the culture difference is indeed there. (Lightner-Noll, 2021, p. 80)

Studies (Mamiseishvili, 2010; Mamiseishvili, 2011; Mamiseishvili & Rosser, 2010) have documented that FB faculty produce fewer student credit hours; a few studies have suggested the lower number of student credit hours results from lower numbers of students per class rather than assignments to teach fewer classes.

Considerable research has documented that language issues and accents cause many students to avoid classes taught by FB faculty; this is particularly true for Asian-born faculty. A USB student said:

> "When scheduling classes, make sure your professor's name sounds American," I was told by several of my friends who were already in college. Several students reported having received similar advice "because school is already hard enough without having to struggle with trying to understand what your professor is saying." (Alberts, 2008, p. 192)

Many FB faculty discuss spending considerable time improving their English and preparing for classes, to overcome the language deficit they feel that they have. Sanki, a biology professor from South Korea:

> I had a problem with accent and students reflected that in their review. But I wanted good reviews for my tenure and promotion. . . . So I tried my best now I went to Toastmasters club. . . . Public speaking is one of the biggest fears for everybody. (Sharma & Ibtesam, 2021, p. 5)

Particularly if they did not receive any of their education in the United States, FB faculty struggle with understanding U.S. higher education and its expectations for students. An African professor with experience in the European system summed these points up as follows: “In Europe and Africa the only thing universities are interested in is to make people competent. If you are not competent, you don’t graduate. Here you want to please the student, so it is a different scenario” (Alberts, 2008, p. 197).

FB faculty tend to spend less time on service activities and to be assigned different service activities than USB faculty. In some cases, the service assignments FB faculty receive are focused on their FB status, for example, organizing events for international day or celebrations. Leela, a Full Professor from South Asia, discussed university efforts to create cultural awareness on campus. She said:

> This idea like multiculturalism, that’s something I don’t like. I don’t like being invited as the [South Asian] in this multicultural event, sort of pigeonholed in a bracket where I am expected to get some [ethnic food] and wear a certain costume and show up. I don’t like that because multiculturalism reinforces difference and makes it purely a matter of culture. (Ghosh & Barber, 2021, p. 1071)

FB faculty are appointed to fewer “important” committees and those that are likely to result in leadership opportunities at the departmental, college or university level.

FB women faculty, especially those from Asia, feel that they are not considered for leadership positions. Almost at the end of her academic career, one foreign-born full professor realized the disadvantage of not being involved actively in administration:

> Now when I look back at my career, I could see a lack of leadership. . . . And this leadership is difficult for a foreigner because I was raised in a traditional role, i.e., to be a little violet—you don't want to open your mouth with your accent. So it's difficult. And many women don't know that they have to learn how to develop the skill how to run a meeting, how to be a leader. (Skachkova, 2007, p. 717)

FB faculty now in a diversity of institutions

Until the early 2000s, FB faculty were concentrated primarily in research-extensive and research-intensive institutions, although some also found employment in liberal arts colleges. More recently, after the Immigration Act of 1990 that expanded the number of immigrants, granted priority visas to highly skilled and educated workers, and created the temporary H-1B visas allowing employment, more international students received their PhDs from U.S. institutions and remained in the U.S. for employment, particularly in STEM fields. Regional comprehensive institutions, four year private and public institutions, and even community colleges, have now hired significant numbers of FB faculty. A geography faculty member stated:

> My university will not sponsor a green card till I get tenure; therefore, I am not eligible for early career funding from NSF or NASA compared to American colleagues. I had to take a job which emphasizes teaching (13-18 credit hours per semester) because I do not have the same access to research funds as my American colleagues. (Theobold, 2009, p.23)

Since China, India, and South Korea are the countries from which the largest number of international students in STEM come, that is reflected in the FB faculty recently hired.

Impact of politics and policies on immigration

U.S. immigration policies as well as the political situation in the country of birth have significant impacts both upon the numbers and country of origin of FB faculty in the U.S.

These policies and political changes create what economists define as pull and push situations that encourage increases in FB faculty in the U.S. For example, in the wake of the fall of the Berlin wall and the end of the Cold War, many FB faculty immigrated from Eastern Europe and former Soviet bloc countries and became STEM faculty in the U.S. The revolution in Iran pushed many Iranian scientists and scholars to immigrate to the U.S. and other countries. A faculty member from Iran stated:

> Things changed in Iran. We came here to get an education, and go back, and help with the revolution. But . . . things changed. The revolution changed. Kids came along and . . . this became our home basically. The last time that I went was five years ago, and each year I want to go but can't because of engagements here. (Carrattini, 2013, p. 5)

The U.S. Immigration Act of 1990 allowed many more international students to come to the U.S. on visas to study and then remain in the U.S. In 2022, the Biden-Harris administration clarified that students on F-1 visas earning bachelor's, master's, and PhD degrees could remain in the U.S. an additional 36 months to complete optional practical training if they were in "high demand professional fields such as STEM." This has significantly increased the number of FB STEM faculty, especially from Asia. A few women discussed how difficulties of their visa processing affected their career decision-making. As an Indian national, Pema's visa

retrogression triggered her job search though she was happy with her position at the time. She said:

> I think retrogression happened at that time. And the date, which was current, for the visa numbers, went back 5 years, which meant for people from India and China, so there was 10 Y. No way I could have been there for 4–5 years and so that was one of the reasons that triggered my job search again. (Chena & Lawless, 2018, pp. 10-11).

Even FB faculty coming from European countries experience issues with immigration that can complicate their careers when transitioning to the U.S. Ashley, a professor from a European country, shared the following:

> I was supposed to start my position in September and supposedly my visa was lost in the mail so they had to ask for a copy. When it finally arrived somebody else was teaching my class. . . . My teaching evaluations were horrible the first time I was teaching a class. (Veliz, 2019, p. 12)

Retention of FB women faculty dependent on integration into broader community

Retention of FB faculty, especially women, depends partly on their integration into the broader community, as well as their department and institution. Several studies have shown that FB faculty may experience difficulty with isolation at the university. Agnese, a woman faculty member from Southern Europe, for example, explained that men with whom she works, "[g]o out for coffee, or they have dinner parties at their houses, and they don't invite me." As the only woman in her department, she is isolated in ways that might appear informal and inconsequential but matter very much in terms of occupational mobility because these men will be the voting members on her tenure case (Ghosh and Barber, 2021, p. 1075).

Studies (Akulli, 2015) have indicated that women in particular may feel better integrated into their departmental, college, and university community compared to their integration into the surrounding community in which they live. Malika, a Black African faculty woman said, “when you go to the store, the way people look at you, the way they look at you when you speak.” (Afoaku, 2015, p. 182)

This may be particularly true of FB faculty in small towns and rural communities where there may be very few FB individuals, especially professionals, not affiliated with the university: “Some parts of the country have a more welcoming and supportive environment than others. . . . However, this is not the case with the states in the Midwest where participants experienced very cold and ambivalent culture” (Afoaku, 2015, p. 180).

FB faculty who are perceived as racial/ethnic minorities in these settings may experience discrimination in the broader community, even when they feel accepted at the university. “People make ethnocentric comments all the time and say ‘Oh, there is a taco stand next to my corner’” (Skachkova, 2007, p. 724).

> Also, that is one thing that helped me a lot adjusting to this culture and also we have faculty that are also like Asian and they really welcome us to some activities outside school, like inviting us to their parties and just getting us familiar with the environment. And gradually, once I passed those, I started to work with improving my language by talking to people, by talking to English native speakers. (Lightner-Noll, 2021, p. 93)
>
> Many African-born women faculty and administrators were not prepared for the idea of separate but equal in the American classroom and neighborhoods. Some of them quickly realized they many not find housing in neighborhoods of their choice due to their race. (Afoaku, 2015, p. 61).

FB women faculty in STEM may be especially isolated in the community, even if quite a few FB faculty from their country of origin are at the university. Many of the FB women in the community may be in the country because they are married to men STEM faculty; they may not be professionals or even working because of visa issues if they entered the U.S. as wives of FB men faculty. Although the FB women STEM faculty are the same gender, they may be excluded from social gatherings organized by these women. This, coupled with exclusion from certain research collaborations and networks by their male colleagues, leads to extreme isolation for some FB women STEM faculty.

FB faculty don't feel at home in the U.S. or country of origin

The pull of family and friends in the country of origin makes many FB faculty feel they are not at home either in the country where they were born or in the U.S. Absence of extended family and the expense and time required for international visits often make it difficult for FB faculty to see their family and friends in their country of origin as frequently as they would like.

> I think I put down more roots in the last five years than I had [earlier in my time in the United States]. . . . Until then, honestly, I would have had to say probably more than 50 percent of my heart was still with the family in India. . . . I [finally] found an emotional framework . . . that I didn't have to such an extent [earlier in my time in the United States]. (Carrattini, 2013, p. 2)

FB women faculty from certain countries and cultures, where the expectation is that the women will foster close ties with the extended family, face a particular burden from such expectations. A woman faculty member from Asia explained:

> They do come visit us and stay for a couple months every year. My parents love it in the U.S. and so far it has been good but it is a concern in the future when they are older and

> you know, need more care. What I should do but that's something I haven't quite figured out yet. (Lightner-Noll, 2021, p. 99)

Births, marriages, and deaths in the family, as well as holidays, exacerbate the feelings of estrangement from their extended family in the country of origin.

Discussion

The six findings above characterize experiences expressed by many FB women faculty from a variety of countries and continents of origin. Some of the literature revealed more subtle findings that applied to particular racial/ethnic groups from certain countries. For example, several noted disparities in the experiences of White FB faculty compared to faculty of color (Ghosh, 2015) from countries in the Caribbean (Hernandez, et al., 2015), Africa (Abla, 2012; Boafo-Arthur & Tsevi, 2021), and South Asia (Lawless & Chen, 2017) regarding discrimination and belonging; this becomes even more complicated when intersected with gender. In some cases, tensions arose because of the institutional type; for example, treatment of Black African vs. African American faculty at HBCUs (Afoaku, 2015; Ochukpue, 2004). Although most of those studies focused on males, Afoaku (2015) noted similar experiences for Black African women faculty. In other instances, the institutional setting in terms of region of the U.S. (Afoaku, 2015; Xue, 2016), particularly in rural settings, contributed to increased discrimination for FB faculty of color, particularly for women, because often the community did not have a large number of FB people, and because FB women of color often reported being less embedded within the community (Akulli, 2015).

Since very few of the studies focused on faculty from regional comprehensive (Roy, 2019; Oka, et.al., 2022; Lin, et al., 2009; Munoz, 2020) or two-year institutions (Bista, 2016; Goodroad, 2019; Markus, 2011) (see column 5, Table 1), it remains difficult to draw conclusions

based upon Carnegie classification of institution, other than noting that FB faculty have increased dramatically beyond R-1 and R-2 institutions and liberal arts colleges, where they predominated before the 21st century. One issue that contributes to this relative understudy of FB faculty outside of research institutions is that much of the qualitative data is found in PhD dissertations (see column 3, Table 1) written by students studying the populations where they are pursuing their degree.

Language, both written and spoken, becomes a significant issue for many FB faculty, particularly those from Asian countries. Written language can hinder research productivity, in terms of writing grants and publications; several faculty underlined the importance of collaborators or use of mentors (Canagarajah, 2018) that were native speakers to help with written English. Spoken English centers as a significant issue in teaching, often leading to poor student evaluations, complaints, and even students not signing up for courses if they know they will have a FB instructor (Alberts, 2008). Facility with spoken English may not suffice, as faculty from India and from England have noted student complaints about their accents in teaching evaluations. As indicated in one of the quotations above, concern over language and accent may also impact service due to inhibitions faculty impose upon themselves from speaking in meetings.

Policy implications

The literature points to a number of policy and practice implications to improve the experiences of FB/FT faculty and enhance success and retention. Some of these policies pertain to higher education at the departmental, college, and institutional level. Other policies and practices suggest changes that federal agencies funding STEM might make, as well as current policies and practices of the federal government likely to influence the numbers of international

students and faculty from certain countries such as China, likely to impact future STEM enrollments and workforce.

Suggested policies and practices for higher education institutions

Orientation. Add issues and challenges that FB faculty may face as an aspect of new faculty orientation received by all new faculty, both FB and USB. During the orientation when diversity, equity, and inclusion issues are discussed, FB status can be included along with race/ethnicity and gender to highlight how particular intersectionalities play out for FB women faculty. This will not only facilitate the transition of FB faculty to institutions of higher education, but will provide USB faculty some insights into particular issues faced by their FB colleagues.

Mentors. Ensure that each FB faculty member has at least one mentor, including an individual who was FB and transitioned to become a faculty member in higher education in the U.S. A repeated recommendation (Bloom, 2017; Phillips, et al., 2016) is the importance of mentoring. Although mentoring is important for all new faculty, it becomes especially significant for FB faculty adapting to a new country and educational system. Ideally, a FB faculty would have more than one mentor, some who are USB and at least one that is FB. If possible, FB women faculty should have a FB woman mentor.

Immigration issues. Provide help and guidance with immigration issues. In addition to a mentor to help guide the faculty member with immigration issues, having a university office that includes individual(s) with knowledge and expertise in immigration issues serves as a critical aid for this process. All deans and department chairs should also have some knowledge of immigration issues, at the very least understanding the impact that immigration issues have on

the FB faculty member's progress towards tenure and promotion and knowing the individuals on campus with expertise to help.

Social isolation. Recognize that FB faculty face the potential of social isolation and provide opportunities to increase their social interaction with colleagues. This becomes particularly crucial for women faculty who may be the only woman in a STEM department and may be excluded from informal networking and collaboration opportunities. Faculty on rural campuses located outside of large urban areas may face isolation from social opportunities and active discrimination, even if they feel included in the university.

Suggested recommendations for policies and agencies of the federal government

For federal government agencies such as NSF. The definition of URM needs to be overhauled for several reasons: First, it fails to include Asians and lumps all Asians from different countries together. NSF does not include Asians as URMs because when lumped together, they are over-represented in STEM compared to their representation in the overall U.S. population. However, this over-representation often does not apply to Asian women in some fields such as computer science, subdisciplines of engineering, or economics. Also, lumping all Asian countries together fails to recognize that individuals from some Asian countries, such as the Hmong, are underrepresented in STEM.

When FB faculty become citizens or permanent residents, some individuals such as people from Spain are counted as Hispanic, while Blacks from Africa are counted as African American. Although such individuals may have experienced racism in their home countries, it is not usually the same type of racism experienced by USB/UST African Americans and Latinx faculty. Counting such individuals as Hispanic or African American also distorts the data, making it appear that more USB/UST individuals became faculty in STEM.

The definition of URM used by NSF should correspond with definitions used in the U.S. census, where Asians are considered as a minority. In addition to being consistent with the U.S. Census, the definition of URM needs to be consistent across federal agencies. For some work, the Environmental Protection Agency (EPA) and National Institutes of Health (NIH) use different definitions than those used by NSF, sowing confusion as to what constitutes a URM for federal purposes.

Federal policies and practices. Federal policies need to anticipate the future impacts of the China Initiative and other U.S. policies and political actions on STEM, since the largest number and percentage of FB graduate students and FB/FT faculty currently come from China, with India and South Korea ranking second and third in terms of numbers and percentages. The China Initiative begun under the prior administration has been documented to have disrupted the research and careers of several high-profile FB/FT faculty from the U.S. (Mervis, 2023; Quinn, 2023). The COVID pandemic decreased the numbers of international students seeking education in the U.S.

Coupling this decrease with the current difficult and evolving political tensions between the U.S. and China suggests that the numbers of international students, especially from China, may not return to pre-pandemic levels. The impact of these policies and trends on undergraduate enrollment, graduate enrollment, and the STEM workforce, including academia, needs to be assessed and anticipated, including its uneven impacts across disciplines. Since over 70% of some U.S. departmental faculty in certain areas such as computer science and engineering are FB/FT, a significant drop in PhD graduates from China could lead to a major shortage of qualified STEM faculty in those disciplines.

Gaps and areas for further research

The results of the analysis confirmed the relative understudy of the significant portion of FB women faculty who make up the academic STEM faculty in U.S. universities. In addition to prioritizing this topic as an area for research in general, several aspects of the topic deserve particular focus and attention.

FB faculty in regional comprehensive universities and community colleges

The focus on FB faculty at research institutions opens the possibility that some of the major findings surrounding FB faculty may not hold in environments outside of research institutions. For example, the finding that FB faculty tend to have higher research productivity may not be the case in institutions where the major criterion for initial hiring, as well as promotion and tenure, is not research. Similarly, the findings surrounding FB faculty production of fewer student credit hours may not occur in regional comprehensive and/or community colleges where hiring and advancement of faculty are centered on teaching expertise, rather than research. Faculty in regional comprehensives and community colleges often also are unionized, depending upon the state and other contextual parameters; union contracts may constrict or impact in major ways the leeway permitted for variations in faculty workload assignment. More research on faculty in such institutions would clarify the issues for FB faculty in those environments and the extent to which they overlap or diverge from those of faculty in research institutions.

Disciplinary variations among FB faculty

Although the predominance of FB/FT faculty in certain disciplines such as engineering, computer science, and even physics and chemistry has been noted, this predominance does not pervade all STEM areas. Tenure-track FB faculty are less prevalent in biology and life sciences,

although they are quite prevalent as post-docs and research faculty in these areas. Although it is not uncommon for FB individuals to receive doctoral degrees in the social sciences from U.S. institutions, FB/FT faculty do not predominate in social science departments in U.S. institutions of higher education.

Impact of COVID on careers of FB women faculty

To my knowledge no research has focused on the impact of COVID on FB women faculty compared to their USB women or men colleagues or FB male colleagues. In addition, it could be important to find out whether COVID made FB women faculty less likely to continue their careers in the U.S. or return to their home country of origin.

Career trajectories of FB women faculty

Much of the limited research on FB women faculty has focused on entry and mid-career FB women faculty. More research is needed to understand the experiences of FB women faculty and the mechanisms that enable their success as they mature in their careers and progress though the life span.

Tension between FB women and FB men faculty from same country of origin

Anecdotal information and rumors suggest that FB women faculty occasionally face discrimination from FB men faculty from their same country of origin, particularly if they are in the same department or college, based upon stereotypical expectations regarding gender roles. Although these FB men faculty may have learned not to place these expectations on USB women colleagues, they may continue to hold and enforce these gender-role expectations for their FB women colleagues. Research needs to be undertaken to understand whether these rumors and anecdotes are based in fact, since virtually no studies have explored this dimension of FB women faculty's experience.

Hiring of FB couples in STEM departments

Only one article (Yabloski, 2016) in this study focuses explicitly on the hiring of FB couples in STEM departments. Since this is a well-known issue in the literature on USB women in STEM, this needs to be explored to understand better the differences between FB and USB faculty on this topic.

Limitations

Limited data that is truly intersectional and includes a focus on race/ethnicity

The field of URM or race/ethnicity was especially problematic, as most of the research on FB faculty lumps all races/ethnicities together. In some instances, race/ethnicity is treated as a variable, but it is not then intersected with gender or FB status in analyses. Several of the 30 articles in the final analysis include only three of the key word fields.

Small sample sizes limit generalizability of results

The majority of qualitative studies have small sample sizes that limit the extent to which their results can be generalized to broader populations. Some of the studies have as few as five subjects or only focus on women from one country such as China or India, limiting generalizability. For example, the Lightner-Noll (2021) study results based on nine women faculty in STEM from China of Confucian belief could not be appropriately generalized to a broader population.

Bias resulting from over-representation of studies focused on women from China and India

Increasing numbers of women from Middle Eastern countries are represented in STEM departments in the U.S., but little research has focused on these women, who may also face discrimination based upon religion, particularly if they wear head coverings, and are perceived as possibly being connected to terrorists.

Definitions

Since researchers may vary in their use of terms such as foreign-born, STEM, URM, and intersectionality, I define the ways in which these terms were used in this study:

Foreign born/Foreign trained faculty (FB/FT)

Although often used interchangeably with immigrant faculty or international faculty or even diaspora faculty, the preferred term according to Akulli (2015) now most commonly used in the literature is foreign born/foreign trained faculty.

Underrepresented minorities (URM)

This study and this report use the NSF definition of underrepresented minorities (NCSES, 2023).

Science, technology, engineering, and mathematics (STEM)

This study and this report use the NSF definition of STEM.

Intersectionality

This study is framed to be congruent with the NSF recognition and definition of an intersectional perspective (NSF, 2021). FB/FT status is a social identity, along with gender and race/ethnicity, that is more salient in this study.

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Appendix: List of Studies Included in the Analysis

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