Journal of Postsecondary Student Success 1(3)
doi: 10.33009/fsop_jpss128231

Examining the Role of Family in the Development of Pre-college STEM Aspirations among Students with Disabilities

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Abstract

In this qualitative cross-case study, we examine the role of familial habitus in providing early access to navigational capital and opportunities predictive of STEM success. Interviews with 18 students with non-apparent disabilities at a large, four-year research university in New England showed that parents and family played a key role in multiple dimensions of student experiences with disability. We organized the findings around three themes about family: (a) family's framing of disability and academic ability; (b) family support of STEM interests; and (c) family as STEM role models. We extend these findings to highlight the importance of family more broadly, supporting research that indicates the critical role that parental involvement plays in the development of STEM aspirations and success.

Keywords: disability; family; STEM; college; pre-college; aspirations

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Although studies consistently show that students with disabilities have similar levels of STEM aptitude and achievement within STEM disciplines to their non-disabled peers (e.g., Bittinger et al., 2021; Martin et al., 2011; Wei et al., 2017), disparities remain in terms of access, persistence, and participation in STEM for students with disabilities. Many students with disabilities are not provided access to anticipatory socialization experiences (e.g., college preparation STEM courses, early lab or field work experiences) that predict long-term STEM engagement. These early experience gaps compound across educational trajectories with fewer students with disabilities selecting STEM majors, completing STEM undergraduate degrees, attending graduate school in STEM, and earning advanced STEM degrees (cf. Hedrick et al., 2010; Martin et al., 2011; Schneiderwind & Johnson, 2020; Wei et al., 2014; Wells & Kommers, 2020). Past studies have established both the obstacles within STEM learning environments and the potential importance of non-academic supports in navigating these unwelcoming environments (e.g., Bettencourt et al., 2018; Dunn et al., 2012; Moriarty, 2007). Despite these obstacles, students with disabilities are persisting in STEM; this study looks at the role of families in supporting that persistence in an effort to improve supports more broadly for this population of college students.

While our previous work on this topic focused on the experiences of individual students within their higher educational contexts (Friedensen et al., 2021), this focused reanalysis looks outside the confines of higher education institutions to examine the role of familial habitus (Archer et al., 2012) in providing early access to navigational capital and opportunities predictive of STEM success. Consistent with this goal, we addressed the following research questions:

1. How do students with disabilities describe their families' response to their pre-college STEM aspirations?

2. How do students with disabilities describe their families' involvement with their pre-college STEM aspirations?

Addressing these questions can impact the ways that institutions and individuals can leverage familial support to help students with disabilities succeed in their STEM fields of study.

Literature Review

This study primarily focuses on the role that familial support and capital plays in the STEM aspirations of students with disabilities. Therefore, we reviewed two bodies of scholarship addressing: the role that family plays in general access to STEM pathways and the role of family in the education of students with disabilities.

Role of Family in Navigation of the STEM Bottleneck

Empirical literature on educational outcomes consistently centers the importance of parental advocacy while highlighting that the capacity to engage in this advocacy is structured inequitably (e.g., Calarco, 2018; White et al., 2020; Whitney, 2016). Expanding the conceptualization of family to include siblings, extended family, and fictive kin provides a fuller conceptualization of family habitus, which in STEM contexts refers to "the extent to which families construct a collective relationship with science and the extent to which this is shaped by their possession of particular sorts of economic, social, and cultural capital… how science is 'woven' into un/conscious family life (or not)" (Archer et al., 2012, p. 886). Prior work shows that STEM aspirations primarily develop between the ages of 10 to 14 and that family shapes students' interest and performance in STEM studies (Archer et al., 2012; Aschbacher et al., 2010; Ferry et al., 2000; Gilmartin et al., 2006). For example, Ferry and colleagues (2000) found that, in a causal modeling study of 791 undergraduate students, parental involvement through support, verbal suggestion, and domain-specific encouragement significantly influenced students' math and science grades as well as students' career development. Parental belief in children's STEM competence also predicts children's interest, self-efficacy, and performance in science and math (Hill & Craft, 2003; Tenenbaum & Leaper, 2003). Family involvement can take many forms including role modeling, advising, coaching, tutoring, and providing resources (Archer et al., 2012; Aschbacher et al., 2010).

While family plays a critical role in the engagement of students in STEM, research also demonstrates variation in parental participation by race/ethnicity, parental level of education, and students' gender that mirror general gaps in STEM participation (Archer et al., 2012; Huang et al., 2000; Martin et al., 2014; Tenenbaum & Leaper, 2003). For example, Tenenbaum and Leaper's (2003) findings from a study with 52 adolescents and their parents reflect parents being more likely to think science is more difficult for their daughters than for their sons. Socioeconomic status can also play a role as Aschbacher and colleagues (2010) found, in their longitudinal study with 33 high school students, that "families with modest means, few apparent connections to SEM [science, engineering, mathematics] professionals, and non-science priorities, were unable to counter schools' negative science messages and stress, provide SEM career models and information, or help students connect to inspiring extracurricular science opportunities" (p. 579). This finding parallels the work of other scholars who suggest having a parent or family member in a STEM profession is an influencing factor in the selection of science and engineering pathways, particularly for female students and Latino and African American male students (Leslie et al., 1998; Mannon & Schreuders, 2007). Mannon and Schreuders (2007) define this family influence as occupational inheritance in which students with a parent who is an engineer or scientist "inherit" that occupation by choosing to pursue the same career or college major.

Role of Family in the Education of Students with Disabilities

Families, and parents in particular, play a primary role in the education of students with disabilities. Research highlights that students with disabilities may face several negative experiences in school related to their academic abilities and that the home can act as a protective force to counter those experiences (Kellner & Freden, 2014). Parental involvement can help improve students' academic self-esteem and the advancement of academic skills (Kellner & Freden, 2014; Spann et al., 2003). Involvement can include engaging in conversations about school, helping with homework, being involved in school-related activities, and advocacy for services (Kellner & Freden, 2014; Newman, 2005).

Since the 1997 amendments to the Individuals with Disabilities Education Act (IDEA), "parents are now equal partners with school personnel, entitling them to access children's school records and participate in the design and evaluation of special education services" (Spann et al., 2003, p. 228). Although the IDEA requires that the parent of a child with disabilities is part of the team that develops the child's individualized education program (IEP), research demonstrates that parental advocacy and participation is connected to cultural and social capital, leading to inequities in students' educational experiences (Fitzgerald & Watkins, 2006; Lian & Fontánez-Phelan, 2001). Higher levels of parental income and education as well as living in a two-parent household are positively correlated with higher parental involvement in the home and in school (Newman, 2005). Additionally, belonging to a support group for students with disabilities or having other external supports/training related to their child's disability also correlates with more frequent school participation by parents (Newman, 2005). Unfortunately, however, findings from several studies also suggest that schools or service providers may not empower parents to be actively involved in the transition process for their children, may not have a positive attitude about the children's success, or may not effectively communicate with families during the process, which can lead to tensions between school and home (e.g., Griffin et al., 2010; Martinez et al., 2012).

There is still little research specifically focused on how family influences access to and success within the STEM bottleneck for students with disabilities. However, in one of the few studies on the role of parents in STEM pathways for students with disabilities, Alston and Hampton (2000), in a survey study with 140 parents and 323 teachers, found that parents believed "that students with disabilities possess the potential to excel in science and engineering if the education system and workplace would provide better accommodations and demonstrate improved attitudes" (p. 163). Additionally, parents described the need for greater role models in STEM for their children and academic preparation in middle and high school that could lead to a college major in STEM in the future (Alston & Hampton, 2000). While these findings provide some insight into the role of families in the STEM access and success of students with disabilities, more scholarship is needed to better understand this critical issue.

Conceptual Framework

Throughout this paper, we use the conceptual metaphor of the bottleneck to understand how STEM pathways might function for students with disabilities. Proposed by Fishkin (2014) and first applied to people with disabilities' experiences by Areheart and Stein (2015), the bottleneck metaphor describes an artificially narrow space in the broader structure of opportunities through which people must pass to reach the highly desirable and more expansive opportunities on the other side. Notably, Fishkin (2014) suggests that these bottleneck stem from broader oppressive ideologies and structures that serve to grant preferred access to some groups while restricting opportunities for others. The bottleneck metaphor acknowledges the societal, cultural, and institutional structures that serve to produce radically different experiences of the same learning environment, which is vitally important for understanding the experiences of students with disabilities for whom an environment welcoming to most can be totally inaccessible (Areheart & Stein, 2015; Friedensen et al., 2021). Although the broader goal in analyzing bottlenecks is to remake opportunity structures, it can also help reveal how people make it through bottlenecks within which they might otherwise have found themselves stuck.

As we have explored the bottleneck for students with disabilities in STEM in more detail in a previous publication (Friedensen et al., 2021), this paper focuses on ways that familial habitus can change the bottleneck experience for their children. While the bottleneck metaphor focuses largely on the opportunity structures themselves, it is important to also understand how outside influences, such as familial capital, may impact one's journey through the bottleneck. In other words, it is not enough to understand only the opportunity structure; we must understand how the structure changes based on individual situations. Based on the literature reviewed above, there is good reason to believe familial habitus may serve to ameliorate the most deleterious effects of the STEM bottleneck in two different ways. First, parents and other family members serve as advocates and can help prevent early bottleneck experiences that might otherwise restrict students with disabilities from moving successfully along STEM pathways. Second, parents and other family members serve as early STEM role models and academic resources as students with disabilities assume greater self-advocacy and decide to pursue STEM education and careers. We therefore consider families' role in shaping the STEM habitus of students with disabilities—that is, the social, economic, and cultural capital that they 'inherited' from the early advocacy of others and their early exposures to STEM—as a key way of resisting the effect of STEM bottlenecks.

Methods

This project was conducted as a qualitative cross-case study. We used this approach to data collection and analysis because it is a flexible methodology that uses comparison across cases to better understand a phenomenon (Stake, 2013)—in this case, students' with disabilities experiences in STEM and the role of family therein. In other words, in

order to acknowledge that disability is not a monolithic experience and to center the unique experiences of each of our participants, we chose to treat each student as a case in order to draw comparisons across their experiences to learn more about the role their families had in their STEM aspirations. Stake's (2013) approach to case study research pays careful attention to the way individual cases are embedded in a broader environment and share common characteristics based on the similar responses to social phenomena; therefore, we believed that this approach would serve us well as we investigated familial capital and its role in STEM aspirations and STEM opportunity structures.

Study Site and Sample

Using convenience, purposeful sampling, we solicited student participants through the Disability Services Office at a large, four-year public research institution in New England. We interviewed 18 students, mostly with non-apparent disabilities. Case study sampling is intended to provide maximum information about either typical or atypical cases (Stake, 2013). By interviewing these 18 students—who fit the case of a student with non-apparent disabilities in a STEM field—we felt that we collected enough data to understand our participants at our case site.

Although all participants met the criteria for a disability accommodation by federal law, which the University uses to structure access to services, we also asked participants how they would describe their own disability. We report student descriptions of their disability in the demographics table because they were more detailed than those provided by federal disability categories. In this paper, we consistently use person-first language (e.g., student with a disability) because our participants described their disability identities in a variety of ways, but all shared the experience of having a disability diagnosis. Additionally, five participants identified as men and 13 participants identified as women. Sixteen participants grew up in the northeastern United States; one grew up in the southern United States and one was an international student from Mexico. In addition to the international student, four participants had immigration experiences: one student was adopted from China, while the other three students' parents immigrated from Poland, Germany, and Israel, respectively. Participants also attended a wide variety of high schools, including public, private, and alternative institutions and GED programs. Finally, four participants transferred to the study site from other postsecondary institutions, including a small state school, community colleges, and an institution exclusively for individuals with learning disabilities. Table 1 summarizes the wide array of participant majors and disability diagnoses.

Table 1 on next page.

Due to the exploratory nature of this research topic, we chose to select a sample reflecting a wide range of STEM fields and disabilities but acknowledge there is also a limitation in aggregating STEM fields as well as disabilities within this study.

Table 1: Participant Major and Disclosed Disability

Participant	Major	Disclosed Disability
Abigail	Psychology	ADHD
Diane	Public Health (Science Track)	ADD
Adrienne	Biology/Italian Studies	ADHD
Scoti	Physics/Astronomy	Dyslexia
Caroline	Chemistry	ADD/ADHD
Casey	Biology/Chemistry	ADHD
Christine	Biology	Seizure Disorder/Learning Disability
Colin	Engineering	Dyslexia
Guillaume	Undeclared (Engineering)	Asperger's Syndrome
Anne	Marketing/Sports Management	ADHD
Lucy	Microbiology	ADHD
Mike	Kinesiology	ADD
Sally	Psychology	ADHD
Sarah	Undeclared (Business)	Auditory Processing Disability
Sophia	Biology	Turner Syndrome/Processing Disability
Stanley	Engineering	Dyslexia
Francesca	Biochemistry	Dyslexia
Jennifer	Animal Science	Anxiety/Memory Disorder

Data Collection and Analysis

Data collection involved a semi-structured interview protocol. We asked questions about both pre-college and college experiences in STEM fields. The protocol included several questions about sources of support and engagement in STEM. Examples of interview questions included: I'd like you to think about your high school science and math courses. What were those like? Did having a disability impact your experience in STEM classes? How did people talk to you about science and math when you were in high school (e.g., parents, siblings)? Since the interviews utilized a semi-structured protocol, interviewers were given considerable latitude to ask follow-up questions—both scripted and unscripted—as participant responses warranted.

Participants were assigned pseudonyms to provide greater confidentiality.

After interviews were transcribed, we used a combination of inductive and deductive coding to structure our analysis. This analytic approach allowed us to both engage the

theoretical framework as a guide, while also remaining open to new and emerging themes, which was important given the nature of the under-researched student population that we interviewed. To engage our inductive analysis, as we read through transcripts, we made annotations at lines in the text that appeared useful in answering the research questions (Saldaña, 2013). We approached our analysis iteratively, continuing to develop new codes throughout the process, and reanalyzing our data as new codes emerged inductively (Saldaña, 2013). Additionally, the deductive codes developed reflect key concepts from the interview protocol and theoretical framework that informed the larger study of which this paper is one part. These deductive codes included psychological, structural, historical, and behavioral aspects of high school and college STEM climates. As each student was treated as an individual case, we compared experiences across all cases as we collected and analyzed the data. This cross-case analysis helped us identify emergent themes that resonated with all or most of the participants and further illuminated the intersection of STEM aspirations and disability.

Family emerged as a prominent theme in almost all of the participants' interviews, specifically related to pre-college experiences and engagement in STEM; thus, we decided to delve deeper into this theme. Moving from the openly coded data on family, we engaged in constructing axial and thematic findings. Through this process we developed three primary themes or categories (family's framing of disability and academic ability; family support of academic interests; and family as STEM role models) that together engage a storyline across cases regarding family engagement in the STEM aspirations of students with disabilities.

Trustworthiness

The researchers acknowledge their identities and how they may intersect with the study and shape perceptions of students' narratives. Thus, we consciously constructed our research team and structured our research meetings to emphasize reflexivity (Krefting, 1999; Lincoln & Guba, 1985). Included among the researchers are scholar-practitioners who identify as persons with disabilities (second and fourth authors), who have worked professionally in a capacity related to special education (second and fourth authors), and/or who have family members with disabilities (first, second, third, and fourth authors). We also used investigator or analyst triangulation, which requires seeking agreement among multiple researchers within a study (Krefting, 1999). Finally, we used thick descriptions wherever possible to ensure the reader can clearly evaluate the connections between a participant's experience, our interpretations of that experience, and the broader conclusions we reached.

Delimitations and Limitations

Due to the exploratory nature of this research topic, we chose to select a sample reflecting a wide range of STEM fields and disabilities. Still, we delimited disability to stud-

ents with a registered disability at the research site's Disability Services Office given that this office served as a gatekeeper to recruiting participants. Additionally, because these students have chosen to self-disclose their disability as part of their educational experience, we also considered that they may be more reflective about the ways in which their disability has impacted their educational aspirations and pathway. The Disability Services Office at the research site defines qualifying disability statuses under the Americans with Disabilities Act of 1990, as amended in 2008. This requires students have a disability documented by a licensed professional providing sufficient evidence that the applicant has a "mental or physical impairment that substantially limits one or more major life activities". Regarding our delimitation of STEM, we focused on students who self-disclosed a science, technology, engineering, or mathematics declared major or that they aspired at some point in their higher education pathway to pursue a major in one of those areas. Given our focus on the role of family in STEM aspirations, we were less concerned about whether a student had made a commitment to a STEM major at the time of the study and more so interested in their interactions with family regarding their aspirations to pursue a STEM major and career.

We also recognize the limitations in our study given that neither STEM nor disability are monolithic experiences. The conclusions we draw are intended as preliminary and require the scrutiny afforded by additional research. This study is further limited by our participant demographics. We were unable to selectively sample for different demographics due to the way we solicited participants through the Disability Services Office. Therefore, our sample is not representative, and the experiences of students with disabilities who do not self-disclose to the institution are missing.

Findings

We organized the findings around three themes found across student cases related to the ways that families impacted their experiences of potential STEM bottlenecks: (a) family's framing of disability and academic ability; (b) family support of STEM interests; and (c) family as STEM role models.

Family's Framing of Disability and Academic Ability

Even before developing aspirations towards STEM fields, participants were socialized by their families' perceptions and reactions towards their disability. Almost all of the participants were diagnosed in early childhood and mothers were described as being early detectors of students' disability pre-diagnosis. Scoti explained that her mother realized she had a disability a year prior to her diagnosis. For Sarah, her mother asked her teachers early on before she was diagnosed to keep an eye on her to help determine if she had a disability. This type of parental involvement and advocacy allowed for early diagnosis of a number of the study participants. Lucy had a dissimilar experience in being diagnosed with attention-deficit/hyperactivity disorder (ADHD) in college and first feared telling her mother, but "I told her [mother] I have Attention Deficit and she

said, 'It sounds about right.'" Thus, Lucy also experienced her mother having a sense or intuition about her having a disability. During that discussion, Lucy found out that her mother also experienced similar symptoms of ADHD growing up, but was never diagnosed. Stanley explained that his mother "was a special education teacher for 33 years and she really understood people with learning disabilities and the struggles I was going through." Although Stanley was the only participant whose parent was a special education teacher, his experience of having a supportive parent with a positive framing of his disability aligns with the experiences of most participants.

Some parents were forthright in communicating with participants about their disability. This was Colin's experience and he said that at a young age, "My parents told me it's a specific thing that's just easier to categorize [as] dyslexic." However, there were a number of parents who did not involve the participants in plans for how to manage their disability in an academic setting or even kept the disability a secret from participants, as Mike's parents did by telling him his ADHD medication was "vitamins." When asked about whether she had an IEP in high school, Scoti explained, "I am not sure about that. My mom was actually in charge of that part. My mom always wanted me to get out of resources by the time I got in high school, so the only real accommodation I had was in my freshman year." For these students, parents took on the role of managing the services and resources they received related to their disability.

Regardless of how parents approached disclosure of the disability, in all but one case, participants described their families believing they would be academically successful. A number of students described their parents as supportive, including Stanley who stated, "My parents have been very supportive and I'm very grateful for that. They understood…that some of the things I may have went through or some of the issues I was having wasn't really my fault." Similarly, Lucy expressed, "If I'm where I am, it's because my family had been very, very supportive of me." This parental support and encouragement made a positive impact on students' educational experiences. It is important to note there is one participant who did not perceive having this type of parental support. This participant, Sally, explained of her disability:

> I kind of saw it all along too, but I never brought it up because in my family. My parents are both from Poland, so they're very anti-mental health and talking about issues. They never tried to seek things to make me feel better, confident in the classroom…so I kind of took it on myself to go see someone for these issues.

Sally later explained that her parents believed that others would stereotype her for having a disability or that she would use it as an excuse in her educational experience, and thus she did not discuss it with them, because "They would just deny it. They'd be like, 'You're just trying to add more problems to your life by labeling yourself that way' and they wouldn't even know really what it was." While in some ways Sally's parents may have felt they were protecting her by not acknowledging her disability, it caused a major tension in their relationship and led her to become her own self-advocate regard-

ing her disability and academics.

Conversely, most participants were comfortable communicating with their families about their disability and academics. Discussing her high school curriculum and family support, Abigail described:

> There was student pressure…All my friends took APs [Advanced Placement classes]. I felt a little out of place. I would talk to my family about it all the time, so it never became an issue for me. My family was on the same boat… Not [to] have to be rushed or doing it ahead of time.

For Colin, his parents encouraged him to pursue math because that is where his strengths lay as opposed to writing. Like Abigail and Colin, most participants described their families encouraging them to engage in academics at their own pace and based on their strengths. The data suggest that while families varied in their early communication to participants about their disability, participants were predominantly socialized in a familial environment that provided a supportive foundation for their academic aspirations and future pursuit of STEM fields.

Family Support of STEM Interests

Across student cases, participants described their families supporting their interests in STEM fields, making them believe it was a realistic aspiration. Guillaume explained,

> My parents kept on encouraging me to pursue whatever I wanted to pursue, and that just happened to be science and mathematics…so I wasn't exactly pressured to go into a STEM field, but I felt naturally that [I] would like to go into a STEM field.

Lucy had a similar experience, "I can tell them [family] I want to be a nuclear physicist and they'll be like, 'Go for it.'" Like Guillaume and Lucy, most participants described their parents encouraging them to pursue whatever career or academic major they wanted to and thus the participants generally felt that their parents would be supportive of any path they chose. None of the participants expressed family members dissuading them from STEM due to their disability or for any other reason.

Families provided verbal encouragement and support, which helped participants believe in themselves and their abilities to traverse any bottlenecks in STEM opportunity structures. For example, Scoti's mother told her about a "doctor who people told him he couldn't be because he was dyslexic. He failed the test multiple times, but he ended up making a device that is used commonly now." Her mother's account of this doctor's experience let Scoti know that her dyslexia would not prohibit her from achieving her STEM aspirations. Colin's father also helped him further his STEM aspirations,

> I was even thinking about going within science and then my dad is in the science field or whatever and he was like, "You know you're going to have to write grants." I was like, "That's probably off the table. What else I can do?" He's

> like, "Engineering." I was like, "Okay but there's many types of engineering. What would I want to do?" He suggested to me electrical engineering… [and] he just told me it's stuff with computers and microchips and vectors. It sounded fascinating to me so I was like, "I'll choose that."

Colin's narrative demonstrates that parents could play a role in helping students figure out what STEM path might be the best fit for their talents and needs. At times, that role may be providing inspiration and emotional support, but at others, parents could provide concrete advice that could shape participants' aspirations as well as help them navigate potential STEM bottlenecks.

Familial support also came in the form of active engagement, rather than solely verbal encouragement. What is interesting to note is that parental engagement often occurred even when the parents themselves were not involved in STEM fields, perhaps indicating that it is the engagement itself that is most helpful. Abigail described her mother as "a huge networker. She knows a ton of people in different fields…that have people that I would be interested in interviewing and talking to and finding out a variety of opportunities that I might consider." Caroline expressed of her mother:

> She was very supportive...I thought I wanted to be a veterinarian pretty much through all of high school … I also thought I wanted to be an engineer. She was very supportive of both of those ideas. She would get me these, usually we go to electric shops, and I would get the wires and tool cutters and figure out how to make a circuit with a light bulb in the middle. She would buy me kits and just stuff that a really geeky, nerdy, 10-year-old would really love.

Even when parents were not familiar with STEM fields, some sought others who could provide participants with assistance such as tutors and career services. For example, Diane expressed,

> She [mom] gives me a lot of credit because she is not in that science or math field…If I need extra help, she totally understands. She'll get me a tutor. But, she can't like help me or anything… she's been supportive but it's not her thing.

These examples highlight that families were not only encouraging of participants' STEM aspirations, but often had the social networks and resources to actively support their aspirations. These resources often worked to help students through bottlenecks by either providing help or supporting STEM aspirations in a proactive way.

Family as STEM Role Models

Many participants within the study discussed having a family member in a STEM profession, which provided positive, early exposure to STEM and examples of how others have maneuvered through STEM opportunity structures. Casey's older brother was a nursing major in college and "was big into math, so he would just read books and talk about that and how he wanted to do mathematics." Likewise, Sally explained of her sibling, "My sister was always really good in math and science. She went to a really

good school for that." Sophia also had a sister who was in STEM, "My middle sister, she's very mathematical. She's math-science, she has a math equation tattoo. She was math major as well." Participants' familial role models demonstrated that pursuing STEM was a feasible goal and something people in their family were good at academically and professionally. Christine explained, "My mother is a nurse and my grandfather was a research biologist, a cancer researcher. So they highly encouraged it." Likewise, Mike described, "My family is ... I don't know what it is about it, but we're always very strong in our math. My grandfather's a professor of math…My dad was a math major. It clicked for me." For Christine and Mike as well as other participants, having a family member in STEM provided an additional level of encouragement, confidence, and assistance in pursuing this pathway.

Although having family members as STEM role models could provide motivation and support for students' STEM aspirations, it could also provide a source of stress to be successful in this area academically and professionally. Lucy explained, "That is one thing, everybody in my family is very intelligent. My dad's an engineer. My mom has a PhD. My grandfather was a self-taught engineer, so there's all this pressure." On the other hand, Mike was also able to seek support when he was failing a math class from his grandfather who is a math professor,

> I felt more comfortable talking to him just because I've known him for so long…so I had felt comfortable asking him questions…He'd go through and he'd correct me and tell me, "Well, this is what you did right, but this is what you did wrong." He just put it in a way that I could get.

Stanley's father was also a math professor, and they shared similar experiences with disability:

> If he went to school at this time, he probably would be diagnosed with ADHD... They basically told him when he was in school in the 50s that he was retarded and that's the word they used back then. He really understands what I go through and understands it's not easy and then it took him a long time to get through college but he eventually actually earned a PhD in mathematics. He's been an inspiration to me.

These quotes show the numerous ways that have family members involved in STEM could both help students with disabilities succeed and apply potentially harmful pressure on them. That being said, having family members as role models illustrated to participants that STEM was innate to their familial identity, which reinforced their desire to pursue those fields regardless of disability. Overall, these themes show that, although having supportive families does not necessarily change the fact that there often are bottlenecks in STEM opportunity structures for students with disabilities, familial capital and resources may help students find ways through those bottlenecks and structural barriers.

Discussion

Although students with disabilities have high STEM aspirations (Bittinger et al., 2021), obstacles in learning environments can inhibit their STEM success. Existing work has focused on the importance of parents (e.g., White et al., 2020; Whitney, 2016). In this paper, we confirm this finding for students with disabilities in STEM but also extend this finding to highlight the importance of family more broadly. For the participants of this study, their parents and family played a key role in multiple dimensions of their experiences with disability: diagnosis, communication about the disability, support for academic and extracurricular interests, and preparation for college. Furthermore, we found that these students' families communicated their support particularly well—several participants noted that their parents and other family members were vocally supportive and provided an encouraging environment for them to pursue their academic goals.

Our study also supports previous research that indicates the critical role parental involvement plays in the development of STEM aspirations (Archer et al., 2012; Aschbacher et al., 2010; Hill & Craft, 2003; Tenenbaum & Leaper, 2003). Over and over again, the theme of supportive parents appeared in the interviews. Our participants described parental support of STEM interests predominantly in terms of verbal support and active engagement. Verbal support included repeated injunctions that told the student that they were capable of succeeding in STEM endeavors and that they should persevere despite the obstacles created by their disability. Several students had parents who actively engaged in developing STEM aspirations, engaging in activities that ran the spectrum from obtaining tutors, setting up meetings with individuals in similar fields, and purchasing science kits and other related STEM toys for their child. The students' positive descriptions of these interactions indicate how important parents' support was in the pursuit of STEM degrees. Additionally, Alston & Hampton (2000) indicate students with disabilities would succeed in STEM levels with appropriate accommodations and enough role models. We found that family members, whether parents, grandparents, or siblings, often fill this important role for students with disabilities.

When viewed through the lens of familial habitus, our study takes on compelling and troubling dimensions. Following Archer et al. (2012), we saw the ways STEM was woven into family life for all but one of our participants. Several students and their families actively incorporated and engaged with STEM in their family life; this is especially noticeable for those students with family members who work or worked in STEM fields. In many ways, these participants benefitted from the STEM-related capital from their families. Other students indicated that academic success, even if not STEM-specific, was a prominent and integral aspect of their pre-college family life. Thus, it was clear that academic and STEM success were situated within these students' habitus. However, there is a relationship between STEM habitus, STEM aspirations, and a family's demographic characteristics, such as race/ethnicity and socioeconomic status (Archer et al., 2012; Huang et al., 2000; Martin et al., 2014; Tenenbaum & Leaper, 2003). In terms of STEM aspirations and disability, habitus plays a role in a

variety of different types of access: access to early diagnosis and medical assistance, access to educational help in the form of tutors or other resources, and access and exposure to STEM-related experiences. Our findings, focused on the pre-college experiences of students with disabilities who achieved college access and majored in STEM, highlighted how having families with an established connection to STEM fields as well as access to economic resources provided them the means to widen STEM bottlenecks through which other students with disabilities might not have made it. Although it is important to note that one student in this study did successfully navigate the STEM bottleneck without a great deal of parental support, even this student had an older sister who majored in math and science, which provided exposure to STEM within her familial context.

Conclusion and Implications

One of the major implications from this study concerns the ways that students with disabilities get through or around bottlenecks in the STEM opportunity structure (Areheart & Stein, 2015; Fishkin, 2014). The effort of squeezing through a bottleneck places a burden on students with disabilities that is not matched for students without disabilities (although they may meet different bottlenecks for different reasons, due to the intersectionality of identities). Our findings reveal the ways that familial habitus, support, and resources help students with disabilities navigate through bottlenecks when they are encountered—or even keep challenges from becoming bottlenecks at all. Since not all students with disabilities have access to the same types or volumes of familial capital, institutions should examine where bottlenecks may be occurring in terms of STEM participation, offer additional support to help more students through the bottleneck, and adopt strategies to remove these bottlenecks wherever possible.

Another key implication of our work concerns its implications for family influences in STEM and in the educational trajectories of students with disabilities. Although often treated as though they are separate discussions, our work fills a gap in the research concerning the experience of students with disabilities relative to the STEM bottleneck by demonstrating the importance of family to the navigation of STEM learning environments. Evidence from our study reaffirms extant scholarship suggesting that family plays a key role in shaping students' aspirations and achievement in STEM education and in helping them navigate opportunity structures (Aschbacher et al., 2010; Gilmartin et al., 2006). Most of the students in our study came from families with established forms of capital that can more readily predispose students to STEM and support STEM aspirations. However, the successful navigation of the STEM bottleneck should not be exclusive to only those with higher socioeconomic status and college-educated parents, as had many of the students in this study. Instead, schools, community organizations, and outreach programs can work to provide families with information about STEM, counsel on setting a positive tone for children about STEM, and encourage course-taking in this area. Additionally, many of the resources provided in the home context of participants in this study can also be offered in the school con-

text such as providing students with mentors or role models in STEM fields, communicating with students about STEM careers and pathways, and encouraging students' regarding their academic potential.

Finally, this study has several implications for future research. Substantially more scholarship is needed on STEM pathways for students with disabilities. In particular, since habitus is shaped by socioeconomic class, this study points to a need for more research that considers multivalent approaches to disability. Scholars and practitioners need a better understanding of the salience of disability identity with respect to gender expression, race/ethnicity, socioeconomic status, and sexual orientation, as well as other identities.

Taken as a whole, this study shows that families were generally very involved in both the development of pre-college STEM aspirations and the academic success of students with disabilities. Additionally, we found that the students in this study described their families' response to and involvement in their pre-college STEM aspirations in predominantly positive ways, emphasizing their families' support, engagement, and positions as role models. Participants did not perceive their families being concerned that their disability would be a barrier to STEM participation. Thus, while extant research illustrates that students with disabilities often struggle to navigate the STEM bottleneck (Alston et al., 2002; Dunn et al., 2012), our findings suggest that familial socialization can act as a protective force in fostering STEM aspirations.

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