

"Academia, as a whole, is structured entirely without any consideration for neurodivergency," and other things neurodivergent students want you to know

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As more neurodivergent and Neuroqueer students are entering higher education, it is important for educators to be cognizant of and understand what it means to be neurodivergent. Importantly, we must uphold and give space to neurodivergent folks' narratives to best understand their experiences and identity, and for us to best engage and support our students. While neurodivergent folks are overrepresented in STEM, there is very little research examining the phenomenon of being neurodivergent in the STEM classroom. As a part of a larger study into this phenomenon, we asked neurodivergent folks at various stages of their careers in physics the question: "is there anything you wish professors or colleagues knew about being neurodivergent?" We here report on specifically neurodivergent students' (undergraduate, graduate, and post-baccalaureate non-academic) responses, and discuss the results drawn from them. We then follow this discussion with recommendations for praxis.

I. INTRODUCTION

Neurodivergent folks are overrepresented in STEM fields [1, 2]. However, when it comes to total enrollment in higher education and eventual completion of their degrees, studies show that neurodivergent students are far less successful than their neurotypical peers [1, 3, 33]. This is especially true for folks identifying with multiple disabilities (ie. being both autistic and dyslexic)[3]. This leads us to an unfortunate conundrum as a field: despite gravitating towards STEM, and being otherwise academically capable [33], STEM fields are regularly inhospitable to neurodivergent students. Dwyer et al. [33] put forth some reasons as to why this is, including stigma based on disability status [5–8], differences in communication styles [9, 10], and intersecting academic/non-academic disability-related barriers [11, 12], and the literature backs these claims up. Still, there is much work to be done to ascertain the full picture [13], and understanding how academia systematically marginalizes and neurodivergent folks is but one small piece to the puzzle. This paper serves as an additional viewpoint, in conversation with the literature, to understand the experience of neurodivergent students, and fill some gaps in what educators should know about being neurodivergent.

There has been much progress in academia with regard to including the voices of disabled people in research [14, 15], and we intend to continue this progress here. Echoing the disability rights mantra "nothing about us, without us," [16] we use this paper to elevate the views and experiences of neurodivergent students to answer the question: *what should neurotypical educators know about being neurodivergent?* To do this, we report on 11 physics students' answer to this question, and qualitatively analyze their responses. These students, whom we will call Wren, Elizabeth, Dmitri, Roger, Tom, Quincy, Sky, Catalina, Henry, Albert, and Louis, each provide an interesting viewpoint on both their reflexive identity and beliefs about being neurodivergent, as well as their relational identity and meta-cognition about how others perceive their neurodivergent identity. In this paper, we will narrativize these responses to form a collective idea on what educators should be cognizant of when it comes to their students. In doing so, we synthesize these responses into four main points. Due to space constraints, we will not be developing individual cases for each subject, however we will attribute ideas to each person as we discuss them, and include quotes as examples of each point.

II. POSITIONALITY

It is important when conducting qualitative research to acknowledge how one's identity and experiences influence the analysis of data [17, 18]. It is also critical to the spirit of this research that analysis is done *with* members of the neurodivergent community instead of simply about them. To this effect, we note that author McDermott is a neurodivergent

physics education researcher. He is also multiply disabled, being hard-of-hearing as well. Author Mosley does not identify as disabled. Both authors identify within the LGBTQIA+ community. We also note that author McDermott identifies as white, while author Mosley identifies as Black. Each author brings an interesting perspective to this research, and we found our respective identities to compliment each other, with our life experiences helping to check each other's biases, prejudices, and neurotypical-normative expectations for how minds/neurotypes should work. Disabled folks and even the most well-intentioned abled folks can, and do, commit ableist acts and analyses [19, 20], so it is critical that these are checked by teammates.

Author McDermott being multiply disabled and neurodivergent allows him to take on a role as an insider to the neurodivergent community. In terms of data collection, this looks like quicker establishment of rapport, and a unique understanding of how to best navigate and structure questions on the fly that are understandable and relevant to a subject during a semi-structured interview. In analysis, being neurodivergent helps understand community-specific subtext which would otherwise be missed by a neurotypical person. In a similar vein, author Mosley's Black identity allows them to take a non-white-centric approach to data analysis, providing insight into oppressive structures, of which McDermott's privileged standpoint obscures from his view.

III. NEURODIVERSITY, NEUROQUEER, AND THE NEURODIVERSITY APPROACHES

Neurodiversity is a concept developed in 1998 by autistic scholar and activist Judy Singer [21]. It is, put simply, a celebration of the diversity of minds. Neurodiversity, initially situated as autistic self-advocacy grown from challenges to the medical model of disability and resistance to disability as a means of social control, soon grew to embrace non-autistic "cousins" (folks identifying as dyslexic, dyscalculic, ADHD, etc) [22, 23], and eventually more "relatives" (folks identifying as epileptic, OCD, schizophrenic, Tourette's, etc)[23, 24].

Further work has since reinforced concepts central to Singer's original neurodiversity concept, such as the anti-capitalist philosophy which rejects exclusion of disabled folks from society on the grounds of "productivity" [21, 25, 26], and the rejection of the socially constructed "normal" [21, 25, 27]. Scholars have since built on these concepts, introducing ideas from Crip Theory [28, 29] and Gender and Sexuality Studies [30, 31] to assert neurodiversity as a Queer thing: a Neuroqueer thing [30, 31]. As such, being neurodivergent and claiming neurodivergency as an identity serves as a tool (in Lorde's [32] "Master's Tools" sense) to question, subvert, and dismantle neurotypical and ableist norms.

For research and praxis involving neurodiversity, Dwyer [33] discusses the "Neurodiversity Approach" as a way to model disability, stating "Instead of there being one singular neurodiversity paradigm, it might be more accurate to

speak of multiple 'neurodiversity approaches'" (p. 75). As Singer [21] asserts in her seminal work, neurodiversity is grounded in direct opposition to the medical model of disability, which describes disability as something negative which is to be cured to achieve social equality for disabled people. Traditionally, when eschewing the medical model, disability scholars turn to the social model of disability, which describes disability as socially constructed based on neutral natural human variation, and thus social equality is achieved through dismantling barriers to access. However, this binary, Dwyer and Singer assert, is counterproductive to social change and does not reflect the reality of neurodivergent identity [21, 22, 33]. Especially when considering disability situated within the mind, binaries do not sit well. Neurodiversity, instead of existing in the social/medical binary, sits somewhere between. Being neurodivergent is interactional. It's relational based on a person's inherent qualities (like the medical model [34]) interacting with their environment and vice versa (like the social model [34]). Critically, the neurodiversity approaches and research/praxis which include them reject the idea of "curing" neurodiversity, and instead assert that neurodiversity should be a celebrated part of the human experience.

No movement is above critique, and we would be remiss if we did not discuss critiques of the neurodiversity movement in this paper. Critics of neurodiversity, the movement, the paradigm, and the approaches, state that the theory centers "high functioning" neurodivergent folks, and invalidates/silences those who are nonverbal, "low functioning," etc. [35, 36] This concern is valid, and research which centers neurodivergent people must be aware of this and do everything possible to uplift *all* voices of neurodivergent people [15, 38, 39]. One push-back to this, however, lies in this dichotomy of high/low functioning, the neurodiversity movement has space for all [37, 40]. Core to the neurodiversity movement is the idea that high and low functioning labels oversimplify neurodiversity as everyone has both low and high needs to exist in the world [41]. Instead, there is a spectrum of folks whose maintenance of their bodies and minds are considered too much for a neurotypical-normative or abled-normative society.

Other critics indicate concerns about how the neurodiversity movement is made up of a majority white population, who are often of privileged class [35, 42]. These are extremely valid concerns, and there are many explanations as to why this is. White people are more likely to be believed by doctors and receive diagnoses in line with being neurodivergent, and consequently the care needed to set them on the course to feeling they belong in the neurodiversity movement [43]. In addition, people who are from lower class backgrounds, especially in the USA, often do not receive medical care, including mental and psychological healthcare [44]. It is therefore important that we take an intersectional approach to this and future research on neurodivergent experiences, narratives, and identities, and that we do what we can to assure a representative sample in our research [45].

IV. DATA COLLECTION AND METHODOLOGY

As part of author McDermott's dissertation study examining the phenomenon of what it means to be neurodivergent in physics, he collected interviews with 19 neurodivergent physicists at various stages of their careers. This includes undergraduates in at least their 3rd year of school, graduate students, post-baccalaureate non-academic physicists, and post-graduate physicists. Subjects were collected using a convenience sampling method, based on subject relationship to author McDermott. Subjects took part in a 1-2 hour semi-structured interview in which they were asked questions pertaining to their experience as physicists, as neurodivergent people, and the intersection of those two identities. Of these 19 physicists, we here report on only 11 students' responses.

Subjects were asked, as the final question in the interview, "is there anything you wish professors or colleagues knew about being neurodivergent? This question was initially included to assure that we hadn't missed any information about being a neurodivergent physicist, as this is a phenomenology study, and as a friendly way to reinforce the guiding principle of this project: that we wholeheartedly and enthusiastically want to include the interviewees as active participants in the research process. Starting from our first interviewee, however, it became evident that this question warranted special attention. This question, coming after a lot of structure to get at specific facets of identity, allowed for an unstructured reprieve for folks to speak their mind on subjects near and dear to the heart of their identity.

On the subject of inclusion of subjects as active participants in the research process, we engaged in member checking. Subjects were asked to review this paper before submission and provide any alterations they felt was necessary to best reflect their views accurately and responsibly. We have no reason to believe subjects would agree on all points to appease the researchers, as they have no incentive to do so, and were repeatedly assured throughout the interview that they are in full control of their own information.

Subjects were asked to self-identify at the end of the interview. Of the 11 subjects, 4 identified as men, 5 as women, and 2 as non-binary. 4 subjects identified as trans/nonbinary, and 7 identified as cisgender. 3 identified as post-baccalaureate non-academic physicists, 2 as graduate students, and 6 as undergraduate students. All 11 subjects identified as white.

We analyzed the data using thematic analysis. We took a latent approach to the analysis, focusing on subtext and using experience gained through being in the neurodivergent community. We took an inductive approach to this method, individually familiarizing ourselves with the data, coding the data, and coming together to discuss and find consensus in coding. There were no instances where we were not able to reach consensus. We then organized our codes into four themes, discussed in our Results section. After writing-up this paper, themes were verified by subjects via our member checking process to ensure proper representation of their ideas.

V. LIMITATIONS

No study is without limitations, and this study is certainly no exception. The most glaring example of this to the authors is that the entire subject population is white. This means that our data reflects a very white view of neurodiversity. Neurodivergent identity as it intersects with race is a topic of much valuable discussion [42], and we are going to remedy the lack of a racially diverse subject population in further reports using an expanded dataset. Another limitation to this study is that we are specifically examining only "success stories" of neurodivergent physicists (those who stay in physics or retain their identity as a physicist). In limiting the data, however, we gain insight into what works in driving student success in addition to what does not.

VI. RESULTS

One thing that must be noted here is that the neurodivergent community is a remarkably heterogeneous one [46]. There is no such thing as the one way to be neurodivergent. That being said, we are a community of people who have come together due to similar experiences being marginalized by society due to differences in how our minds work. The responses to the question "is there anything you wish professors or colleagues knew about being neurodivergent?" are exemplary of this idea. No two people presented in this paper have the same identity, and none of them have the same experiences. Students we interviewed identified with Obsessive Compulsive Disorder (OCD), Dyslexia, Attention Deficit Hyperactivity Disorder (ADHD), autism, epilepsy, Bipolar Depressive Disorder (BPD), and Schizoaffective Disorder. Students were cisgender, transgender, and nonbinary. They also identified as bisexual, heterosexual, and demisexual. However despite this heterogeneity, it was remarkably easy to condense the 11 responses to four themes. Below is this list of things that neurodivergent students want *you* to know:

- Professors need to both understand and accept that they are ill-equipped to teach neurodivergent students.
- Coming out as neurodivergent is an often last-ditch effort to succeed in class due to stigma, and is a very vulnerable thing.
- Being neurodivergent is a fundamental aspect of being oneself.
- Not everyone knows they are neurodivergent.

We will break down each point in the next four paragraphs, though it should be noted that some quotes may reify multiple themes at once.

Regarding ill-equipped professors: The most common thread which linked the responses is that, in these neurodivergent students' experience, professors and those in power are ill equipped to teach neurodivergent students. To this effect, the only thing Quincy cites as what she wanted professors to know, "I just wish [professors] as a whole were more informed." Wren, perhaps, put it best, giving us the title: "I

wish there was an understanding that academia, as a whole, is structured entirely without any consideration for neurodiversity." This sentiment is echoed by Henry, who states, "we need to be educated differently. It doesn't mean we're stupid or can't learn, it's that we can't learn and truly thrive in the current state of physics education." Folks also acknowledged that, for right now, we don't have all the answers, but students understand that there is a fundamental problem with how we teach neurodivergent students. This idea is held up by Albert, who says "I'm trying to figure out myself... I have still not figured out exactly what I'm working with here." That is not to say that there isn't insight to be gleaned, however. Tom pointedly states, "neurodivergence really can turn up [little] differences... and sometimes that makes people very difficult to work with. But patience is probably the best medicine."

Regarding coming out as neurodivergent: Elizabeth gives an especially powerful statement on our second point. "I wish sometimes that [professors] knew that I'm not trying to be neurodivergent. The last thing I want to do is to have to ask for accommodations." She expands this statement outwards, "for a lot of people it's very difficult to even start that conversation. So I think if you get to a point where your student is coming up and asking you 'hey, I need this accommodation,' think how much of an internal struggle that student had to actually get to this point. And you should acknowledge and be cognizant of that." It's important also to acknowledge that students who ask for accommodations at the beginning of the semester have likely had to go through the process of struggling to receive accommodations from other professors many, many times before. The fact that they are approaching a professor with this request is because they *know* that this is the solution that works for them. It is also incredibly important to understand, especially if professors have never had to go through this process personally, that accommodation requests phrased in the form of a question should not be treated as requests, and are usually phrased as questions for the sake of politeness, as English speakers often use conventionally indirect strategies to assert need [47]. When asking for accommodations, students are not asking, and it is counterproductive to their learning to treat it as such. Sky puts it well, saying "if neurodivergent people are telling you that they're neurodivergent in whatever way that is, that it's them being vulnerable and honest and it's not something to look at as an excuse."

Regarding the fundamentality of being neurodivergent: while it is possible to hide being neurodivergent for some, hiding it (masking) takes a mental toll [48], but revealing it to others opens oneself up to ridicule [49], or worse physical or social violence [50]. Henry speaks to this: "we are fundamentally different and think differently than a neurotypical person, which means we need to be educated differently." Louis seconds this, saying, "the way in which we learn is not always the same as a non-neurodivergent [person]." Students, critically, want professors to know that the mismatch between the fundamentality of being neurodivergent and how the rules of the classroom are built is why they may miss class, not turn

in work, or any number of things which cause their grades (and potentially their relationship with professors) to falter, not that they simply don't care. Roger implores, "I wish they knew that even if, like, when I was like really struggling and not train homework and not going to class... it wasn't because I hated the course or anything like that, it was because of my neurodivergence." This fundamentality is, critically, not to be viewed as deficit, but to be viewed as an important and *good* part of the human experience. Sky shares her perspective on this. "For one thing, I feel like the more we learn about neurodivergency, and the more we learn how many people there are who are neurodivergent and how many types there are, and how truly incredible the brain is of coming up with different ways to maneuver, to craft itself." She concludes, "I think it's something to be celebrated."

Regarding many people not knowing they are neurodivergent: Tom speaks to our fourth point, saying, "it's a complex and unique experience for each student. Everyone's a little bit different... and sometimes people are not aware of that in themselves." Multiple subjects cited that having empathy towards neurodivergent students not only helps them succeed, but helps us be kinder to ourselves, even if we're assigned neurotypical. In fact, many subjects spoke about their own journeys towards being cognizant of their neurodivergent identity, often because others helped them succeed because of their differences, not in spite of them. Louis states, regarding "I guess it's not with every professor. Again you'll have professors who are quite open about this especially. Neurodivergent professors, as you might expect." Catalina furthers this idea, saying, "I feel like there's a lot of [professors] that are neurodivergent, but don't really acknowledge it, or don't really know it, or they just came up with really good coping mechanisms." She continues, "That's something that should be acknowledged, there's a lot more people out there that are neurodivergent than those who are willing to acknowledge." Many people simply don't know they're neurodivergent due to differential access to healthcare or being in an environment which so heavily encouraged masking (neurodivergent folks covering up being neurodivergent by acting neurotypical). It is therefore critical, not just to folks who are comfortable in their identity as neurodivergent, but also for folks who have not made that journey yet, that we pay special attention to how we teach our students and that we teach in a neurodiversity-inclusive way.

VII. RECOMMENDATIONS FOR PRAXIS

Where do we go from here? It is clearly not enough, from our first point, to simply point out that a problem exists in educating and including neurodivergent students in higher education. Action must be taken to educate educators on good changes to make to curriculum and classroom/laboratory practices. Even more importantly, action must be taken by educators to enact good change. The authors said this before in previous work [24, 25, 51–53], and other

Physics Education Research scholars concur [19] and we will say it again: ableism is done by good people. It is done by good actors who believe in equity and fairness, and is often done unwittingly or in the name of pragmatism. Ableism is normal in academia [54], and it is structural through and through. It takes good people, good allies *resisting* this system of oppression, being vigilant of ways that violence is enacted, often invisibly [55], toward disabled people. We therefore provide the following framework of six tasks for changing praxis to create an neurodivergent-inclusive classroom and laboratory:

1. When possible, be flexible with documentation requirements. Not everyone can afford to see a doctor, and many learn what access needs they require through trial and error. Further, do not treat accommodation requests as questions. They are demands.
2. Incorporate pedagogical practices inclusive of neurodivergent students' access needs, such as Universal Design for Learning.
3. Include the narratives of disabled people in your lessons and storying of physics.
4. Include neurodivergent students in your research.
5. Be flexible with due dates and mandatory attendance.
6. Assume that students are, first and foremost, competent at the tasks they are given, and work up from there to help their performance align with their competence.

Much like Amendment IX of the United States' constitution, we acknowledge that we have not given every possible recommendation for praxis which ensures the inclusion of neurodivergent students in the physics classroom. We are also aware that certain institutions have very strict processes for students and professors to follow when engaging with accommodation requests. An incredible way to dismantle oppressive structures is to act within them when we have the privilege to do so, but to always remember Lorde's words, that "the master's tools will never dismantle the master's house" [32]. It is critical that those with privilege not sit idly by and simply be nice able-bodied people. It is important to remember that social acts are shared acts, communication especially [20]. Additionally, we must remember that being disabled and being neurodivergent are both remarkably individual things, and thus what works for one neurodivergent person may not work for every neurodivergent person. It is therefore important to engage in productive two-way communication with students. If you see students are struggling in class, reach out to them and ask to work together to find solutions. When students reach out to you, work together with them to find solutions. Be kind above all else.

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