

Considering Neuroqueer Theory in Engineering Education Research

Mx. Theo E. Sorg, Purdue University

Theo Sorg (they/them) is a PhD candidate and National Science Foundation Graduate Research Fellow in the School of Engineering Education at Purdue University. They received their Bachelor's degree in Aeronautical and Astronautical Engineering at Purdue University. As an undergraduate, they also received a Cooperative Education Program certificate for their work as a Pathways Intern at NASA's Johnson Space Center. Their research interests focus on understanding and challenging how the institution of engineering education shapes the experiences of trans and neurodivergent students.

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This critical theory research brief considers the potential of neuroqueer theory to address the shortcomings of existing approaches to gender, neurocognition, and disability in engineering education research (EER). Despite repeated calls for change in approaches to gender [1] - [4], engineering education researchers continue to rely on oversimplified, binary, and cis-normative conceptualizations of gender. This approach leaves no conceptual space for transgender and/or gender non-conforming people (abbreviated ‘trans’ hereafter), tacitly denying their/our existence and effectively erasing them/us from the field epistemically [4]. Further, the current dominant approach to gender in EER leaves little room to theorize gender’s interdependency with other systems of power.

With respect to disability, much of the scholarship in EER to date has focused on disabled people only as ‘customers’ for engineering projects, drawing implicitly on an oversimplified medical model of disability [5], [6]. Most EER does not recognize the potential for engineering professionals, students, and/or educators to be disabled, rendering them/us unrecognizable in the current dominant paradigm. This erasure may be especially obvious for neurodivergent engineering students, given the normative assumptions about neurocognition embedded in educational contexts. Though neurodiversity is a growing area of interest in EER, the topic remains limited in both quantity of works and depth of theorization [7].

Thus, neuroqueer theory, which reckons with the intersection(s) of gender, sexuality, disability, and neurodiversity, presents a potential path for addressing several areas of theoretical limitation within EER at once. In the next section, I provide a brief overview of neuroqueer theory. After, I consider the precedent for neuroqueer theory in engineering education, highlighting how it can build upon existing work and open new avenues for study. Finally, I consider potential pitfalls to adoption specific to the engineering education context, offering guidance to researchers considering adopting the perspective in their work.

Neuroqueer Theory: A Brief Overview

Much like ‘neurodiversity’ [8], the term ‘neuroqueer’ and associated theoretical perspective originally came about through community effort, particularly in essays and discussions posted in neurodivergence-related online spaces in the early-to-mid 2010’s [9]. Consequently, no singular individual or research group is considered the originator of ‘neuroqueer’ or neuroqueer theory, though prominent early figures include Nick Walker [10], Remi Yergeau [11], Athena Lynn Michaels-Dillon, and Ibbey Grace [12].

As neuroqueer theory is arguably an extension of queer theory, the two share some common ground. Both queer and neuroqueer theory refer to theoretical perspectives that challenge forms of normativity and unsettle associated essentialist notions of social categories. Though commonly used colloquially as an identity label in the contemporary, the term ‘queer’ in the context of queer theory is often treated as an action. That is, rather than *being* queer, queering is something one *does*. Queering is, broadly speaking, the act of subversion, disruption, rejection, and/or challenge of gender normativity and heteronormativity. In this context, when ‘queer’ is used as an adjective, it is still connected to the idea of queering as an action; calling oneself queer, for instance, could refer to an ongoing commitment to engage in queering rather than referring to a social identity label. Over time – outside of the specific context of academic gender

studies – the term ‘queer’ has increasingly been used as an identity label, one not always associated with a commitment to queer. The term ‘neuroqueer’ has followed a similar journey, beginning as primarily an action first and later increasingly becoming an identity label (albeit much less common than ‘queer’). In this essay, I privilege the neuroqueer-as-action understanding of the term unless otherwise noted.

Relatedly, researchers should keep in mind that neuroqueer theory, like queer theory, has a complex, critical relationship to identity. Neuroqueer theory, as a theoretical perspective, is *not* synonymous with ‘the perspective of individuals who are both queer and neurodivergent.’ While the perspectives and lived experience of neurodivergent and queer individuals are important and valuable, given neuroqueer theory’s emphasis on *doing* over *being*, group membership does not make one an expert in neuroqueer theory. This also means that neuroqueer theory is not restricted to those who are neurodivergent and/or queer. Further, as Walker [10] emphasizes, anyone can neuroqueer, regardless of bodymind.

While queer theory is primarily (though by no means exclusively) focused on gender normativity and heteronormativity, neuroqueer theory also brings explicit attention to neuronormativity. The term ‘neuroqueer,’ as argued by Barnett [9] in her synthesis of emergent neuroqueer theory scholarship, “is used both to articulate the queer nature of neurodivergence and to examine the entwinement of the two” [p. 5]. *Neuroqueer* extends the act of queering into the realm of neurocognition and neuronormativity. That is, in the language of Yergeau [11], it is a recognition of ‘neurological queerness’, of the potential to queer normative expectations of neurocognition. At the same time, it is also a recognition of how gender normativity, heteronormativity, and neuronormativity are all fundamentally entangled. Neuroqueer theorists, like queer and disability theorists, often draw on the notion of embodiment in their analysis. They also typically challenge the separability of mind and body, drawing on language such as bodymind to emphasize their inseparability. Further, neuroqueer scholars also similarly reject bioessentialist understandings of gender, sexuality, and neurotypicality, instead understanding them in terms of performance.

Precedent in EER

In this section, I describe how two major notions in neuroqueer theory have been explored in engineering education research to date. First, I discuss how researchers have explored embodiment (and relatedly, disembodiment) in the context of engineering. After, I discuss empirical research that has pointed to gender/sexuality and neurodivergence/disability as being interconnected.

(Dis)embodiment in Engineering

Riley [13] draws on Queer Theory and Disability Theory to examine how different bodies are/aren’t recognized in engineering. In her examination, Riley highlights how masculinities in engineering have shifted over time from a distinctly embodied, ‘rugged outdoorsmen’ ideal (à la President Theodore Roosevelt) to an abstracted, disembodied ideal (though some embodied masculinities exist in the contemporary, wherein that embodiment is tightly constrained). The shift towards disembodiment – that is, towards an engineering that is somehow separable from the body – presents a false neutrality. Though being ‘bodiless’ would suggest a kind of universality, this shift is not actually a lack of body but rather a “disciplined denial of the body”

[Disembodied Masculinities section]. The refusal to acknowledge the body does not actually create neutrality but rather leaves existing normative beliefs and power relations – those that privilege white, non-disabled, heterosexual, cisgender, masculine bodies - unchallenged.

Other engineering and STEM education researchers have considered embodiment in the context of technical competence and rigor [14, 15]. Though often presented as disembodied in engineering and STEM more broadly, these scholars argue the current, dominant understanding of technical competence is inherently embodied. Further, being deemed ‘technically competent’ currently requires a ‘typical’ bodymind. While Slaton [14] emphasizes physical disabilities by drawing on the case of a blind undergraduate student in chemistry labs, she argues technical competence relies on normative beliefs about the mind as well, calling for us to “question our definition of intellectual wholeness” [Introduction section, para. 5].

This prior work has already demonstrated that understanding embodiment in the context of engineering education can help researchers trouble accepted distinctions and definitions and recognize the role normativity can play in perpetuating systems of power. At the same time, much of this work focuses on motor or sensory capabilities, leaving neurodivergent forms of embodiment largely unexplored. Neuroqueer theory, then, offers an opportunity to build upon this work by suggesting and enabling new avenues for critique. How does our understanding of technical competence implicitly require neurotypicality? How would engineering education (culturally, structurally, instructionally, and/or otherwise) need to change to welcome neurodivergent bodyminds?

Intersections of gender/sexuality and neurodivergence/disability in EER

Though neuroqueer theory has not seen much (if any) use in the field to date, the idea that gender, sexuality, disability, and/or neurodivergence are interconnected is not without precedent in engineering education research. As mentioned earlier, Riley [13], for example, has conceptually linked queerness with disability in engineering through embodiment, though their work focuses more on queerness and disability in parallel.

Others have linked gender and/or sexuality with disability and/or neurodivergence through empirical studies of individuals who are simultaneously queer/LGBT+ and disabled/neurodivergent. For example, Miller and Downey [16] have drawn attention to the climate that disabled, LGBTQ students face in STEM, painting a bleak picture of “isolation, tokenization, and an overall chilly climate in the classroom and on campus” [p. 179]. Miller and various colleagues have also reported on the experiences of disabled, LGBTQ+ students in higher education more broadly, including climate perceptions, microaggressions, mental health & wellbeing, and identity navigation, disclosure, & visibility [17 – 23]. Through their work, they have argued for more research that considers multiply marginalized students, where their identities are considered in tandem instead of analyzed separately.

Outside of Miller & colleagues, other researchers in STEM education have been prompted to touch on neurodivergence alongside queerness by their participants - though the focus of the work remained on queerness [24, 25]. The reverse is also true; other researchers have been prompted to include queerness in (initially) disability-focused research [26]. Collectively, these works suggest that STEM students who are both queer/LGBT+ and disabled/neurodivergent might already see these dimensions as intertwined, which STEM/engineering education research

may be failing to adequately recognize. By emphasizing gender/sexuality and neurodivergence as fundamentally intertwined, neuroqueer theory can help EER better reflect the experiences of engineering students, educators, and professionals who are both queer and neurodivergent. It can also help address the need for more research which considers multiple forms of marginalization experienced simultaneously. Though neuroqueer theory emphasizes critique of gender normativity and neuronormativity, its embrace of the interwoven nature of normativities leaves room to incorporate simultaneous analysis of other forms of normativity.

Potential Pitfalls

In this section, I consider how trends in EER might limit neuroqueer theory's potential to address some of the shortcomings of existing work – namely, the superficial adoption of neurodiversity and the continued epistemic erasure of trans people.

Superficial Term Adoption

As mentioned previously, though research interest in neurodiversity and neurodivergence in engineering education has increased notably in recent years, it is still a relatively niche topic in the field by number of published papers. Additionally, as I have explored in earlier work [7], researchers are still struggling with basic terminology and concepts. The continued, strong presence of pathologizing language suggests few researchers are actually engaging with the neurodiversity paradigm. Together, these findings suggest researchers may be superficially adopting new language without meaningfully engaging with the associated scholarship. Neuroqueer theory, sharing a similar origin to the neurodiversity paradigm, could be at risk of the same treatment in EER.

Though neuroqueer theory is novel to engineering education research (and relatively novel to academia more broadly), the issue of 'buzzwordification', of superficial term adoption without accompanying paradigmatic shift, is not. Avoiding this potential pitfall is a complex issue, one made more complex by the subversive aims arguably at the core of neuroqueer theory. While generally the solution is for researchers to approach neuroqueer theory's theoretical depth with vigor [27], what constitutes vigor in this context? How does one approach neuroqueer theory vigorously? These questions are ones we must ask ourselves collectively as well as individually, and my intention is for this paper to begin that conversation. In addition to reading relevant literature (such as beginning with those cited in this essay) and discussing with peers, I note that engaging in neuroqueering could be a valuable avenue for vigorous engagement.

Reification of the Epistemic Erasure of Trans People

Despite being marginalized by gender in engineering, little gender EER even recognizes the existence of trans people [4]. While some noteworthy works have focused on transgender and/or gender nonconforming people specifically [e.g. 4, 28], most engineering education researchers group trans people only as part of the LGBTQ+ umbrella. Especially given how 'queer' is commonly used even in engineering education research as an umbrella term for the LGBTQ+ community, there is a risk researchers may bring the same positioning of [trans] people to neuroqueer work. As Haverkamp et al. [4] argue, LGBTQ+ umbrella approaches in engineering

education research “will not yield findings necessarily pertinent to TGNC [transgender and gender nonconforming] individuals” [p. 58]. This is in part because the relatively small number of trans individuals in the broader LGBT+ community means their experiences are likely to be overshadowed in aggregate data sets. However, there is also a more conceptual limitation. Though the LGBT+ umbrella spans both sexuality and gender, there is a tendency in engineering education research to oversimplify the two dimensions into one, often by conceptually discarding or minimizing gender. The result can be research that implicitly and problematically positions the root of trans marginalization in sexuality, ignoring the obvious inconsistency that trans identities are not sexualities. Even research that considers gender and sexuality as interconnected and/or alongside each other, trans identities can be implicitly mischaracterized as sexualities, if not left by the wayside altogether.

As an example of this phenomenon, I consider the work of Leyva et al. [29], which considers both gender and sexuality as analytical categories, as well as explicitly draws on Queer Theory. In their review of engineering education research focused on technical/social dualism, Leyva et al. are concerned with destabilizing the “heterosexist ideology underpinning the dualism,” where heterosexist is defined as “prejudiced and discriminatory towards gender-nonconforming individuals” [para. 2]. In this paper, trans individuals are only mentioned explicitly when initializing the LGBTQ+ acronym. At one point in their analysis, the authors drop a portion of the acronym and only consider LGB experiences, ostensibly matching the terminology of the paper they are reviewing. Rather than directly acknowledge the lack of trans people or otherwise consider the theoretical consequences of the shift for their analysis, the authors obscure the difference by lauding the work as having a “non-binary, non-heterosexist theorization of gender” [Professional and Personal Identities section, para. 7]. In the context of the text, Leyva et al.’s use of the term ‘non-binary’ seems to refer not to a gender identity but rather describes a non-essentialist conceptualization of gender that does not confine men and women to masculinity and femininity, respectively. While conceptually this allows for more variety within the gender identities of men and women, it fails to recognize identities outside of men and women as well as the possibility of movement between the two. Further, this example reflects a broader trend in the paper of ambiguous language pointing to an over-equating of cis LGB+ experiences of gender non-conformity with the experiences of trans people by ultimately ignoring the latter group. Though gender non-conformity is a major focus, the article seems to be primarily - if not exclusively – concerned with cis women’s (and to a lesser extent, cis men’s) deviations from traditional gender norms, leaving trans people out of the conversation.

I argue Leyva et al. are thus failing to divest “from tacit assumptions of cisgender normativity and the gender binary,” [4, p. 58] reflecting a tendency Haverkamp et al. found in gender EER at large. At the same time, Leyva et al.’s work does move beyond a simple, essentialist notion of gender and explicitly draws on Queer Theory, which suggests our existing understanding of Queer Theory in engineering education may not be enough to ensure conceptual space for trans people. Attending conceptually to transness is especially important in the context of neurodivergent people, as recent work indicates neurodivergent people are more likely to be gender non-conforming than neurotypical people [30-33]. Researchers interested in using neuroqueer theory, then, in the context of engineering education, must make a point of making meaningful conceptual space for trans people and their/our bodyminds. Without this conscious effort, attempts to bring neuroqueer theory into engineering education may further perpetuate the field’s epistemic erasure of trans people.

Conclusion

Given the current state of the US with respect to anti-trans backlash and erasure attempts (e.g. [34] – [37]) as well as worsening anti-neurodivergent rhetoric (e.g. [38], [39]), it is more important than ever that engineering education researchers challenge oversimplified conceptualizations of gender and disability/non-disability that further ostracize trans and neurodivergent people. Neuroqueer theory, a developing theoretical perspective informed by Queer Theory, Disability Studies, and the neurodiversity paradigm, could be a valuable approach for engineering education researchers to begin addressing this issue. Extending the notion of queering into the neurological, neuroqueer theory simultaneously recognizes parallels between the imposition of gender- and neuro-normativity as well as their entanglement.

Bringing neuroqueer theory into the engineering education context can help build on emergent empirical work in the field suggesting individuals who are both queer and disabled/neurodivergent may already see the two as intertwined. It also offers the opportunity to build on prior work exploring embodiment and disembodiment in engineering, further troubling the normative assumptions built into our conceptions of technical competence. At the same time, certain tendencies in EER could substantially limit neuroqueer theory's potential to address the limited meaningful attention given to neurodivergent and trans people in EER. Thus, though neuroqueer theory shows great potential for EER, interested researchers must take a conscientious approach for that potential to be realized rather than squandered.

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