



LGBT+ Faculty and Students in STEM: Heteronormativity, Exclusion, and Isolation

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About the ARC Network

Funded by the National Science Foundation ADVANCE Program, Awards HRD-2121468 and HRD-1740860, the ADVANCE Resource and Coordination (ARC) Network seeks to achieve gender equity for faculty in higher education science, technology, engineering, and mathematics (STEM) disciplines. As the STEM equity brain trust, the ARC Network recognizes the achievements made so far while producing new perspectives, methods and interventions with an intersectional, intentional and inclusive lens. The leading champion in North America to propel the inclusion of women in the field of engineering, the Women in Engineering ProActive Network (WEPAN), serves as the backbone organization of the ARC Network.

About the Virtual Visiting Scholars

The Virtual Visiting Scholars (VVS) program provides a unique opportunity for select scholars across disciplines to pursue research meta-analysis, synthesis, and big data curation on topics crucial to STEM faculty equity. VVS analyze existing research and data, synthesizing different, sometimes competing, perspectives, frameworks, metrics, and outcomes to offer new insights and applications to the broader community.

About the Author

Dr. Ramón Barthelemy is currently an Assistant Professor of Physics and Astronomy at the University of Utah in Salt Lake City. Dr. Barthelemy's current research applies qualitative and quantitative methods to study workforce preparation of underserved student populations and the impact of student perceptions of diversity and inclusion on final course grades and learning outcomes. During his tenure as a Fulbright Fellow, his work in Finland included researching physics education and teaching collegiate courses on international education and equity in science. As an American Association for the Advancement of Science (AAAS) Science Policy Fellow, Dr. Barthelemy's assignment with the U.S. Department of Education included work on national STEM education equity where he also wrote national policy on the matter. Dr. Barthelemy's extensive publication portfolio includes the focuses on experiences of women in graduate physics and astronomy and LGBT+ persistence in the field of physics. Dr. Barthelemy earned his BS in Astrophysics from Michigan State University and his MA and PhD in Physics Education Research from Western Michigan University.

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Introduction

The landscape of papers focused on LGBT issues in STEM began to emerge in 2009 with articles centered on the experiences of faculty, by Bilimoria and Stewart (2009), and applying queer theory to science by Gunckel (2009). Since this time the literature has grown to include articles on students, faculty, workplace issues, and more [1-21]. To complete this review on LGBT STEM research, it was necessary to expand to the broader higher education literature in order to fill in existing gaps [1-33]. This review has revealed a growing area of scholarship that is only beginning to embrace intersectionality and build further lines of thought critiquing the actual practices of science and science education. This report discusses this literature both in STEM and the broader higher education community, challenges in pursuit of this work, and the themes represented in the literature as of Summer 2021.

Literature Search

In total, this analysis includes 26 articles, 4 reports, and 3 dissertations. Of these, 21 specifically focus on LGBT STEM issues, while 12 support this literature by filling in key gaps (e.g. African American and community college students). To find articles, the literature was searched using “Google Scholar” by employing specific keywords following a metasynthesis process laid out by Lachal et. Al. (2017) [34]. This search began with the parameters of including all available articles addressing LGBT or queer issues in STEM. Table 1 below summarizes the search terms used and resulting articles. The second selection process sought to fill in specific holes not addressed in the LGBT STEM literature. These articles were not exhaustively included as were the articles for the LGBT STEM search. Instead, specific articles were selected to support the LGBT grouping of articles. These articles filled gaps surround African American students [28, 30], LGBT students with disabilities [25], community college students [32], faculty coming out [22, 29, 33], faculty generally [26, 27], and transgender students [23].

Table 1

	Search Terms (<i>LGBT and/or GSM</i>)	Number	References
LGBT STEM Articles	“LGBT STEM Education” “LGBT in STEM” “Queer in STEM” “Queer in Science Education”	21	[1-21]
LGBT Higher Education Articles to Fill in Gaps	“LGBT Faculty” “LGBT Students” “LGBT” & “Higher Education”	12	[22-33]

Challenges

The primary challenge in this search is the limited nature of articles specifically addressing LGBT issues in STEM. However, it is important to understand how this literature is growing, and what new areas of investigation are needed to sustain its evolution and include full access to STEM by LGBT persons. Fortunately, the broader literature on LGBT issues in higher education offers particular pieces that can augment and support the STEM base. By using both search strands we were able to fill in critical gaps and inform what work needs to be done in STEM.



Analysis & Key Findings

The analysis of the papers has been completed and included four phases outlined by Lachal et. Al. (2017) [34]: (1) quality assessment, (2) extracting data, (3) analysis, and (4) expression. For each piece of literature, we listed out their research questions, methodology, participant numbers and demographics, results summary, and their conclusions.

Of the articles focused on LGBT STEM issues, eight focused on students, and 13 focused on faculty and the professional STEM workforce. Nine were quantitative in nature and employed surveys and statistical analyses [1, 5, 7, 11, 12, 16, 17, 19, 21]. Participant sampling ranged from 60 to over 35,000. Thirteen papers employed qualitative methods to analyze interviews or open-ended survey responses [1-4, 6, 8, 12-16, 18, 20]. Two further articles looked more holistically at STEM or focused on building an identity model [9, 20]. Combined, they offer a concerning portrait showing heteronormativity in STEM spaces, discomfort with LGBT students and faculty in STEM, and concerns with LGBT persons being out about their identities.

Queer STEM Students

In the literature specific to STEM students, the broadest theme was that of inclusion vs. exclusion and its' consequences. Professional development, research, and networking are all essential for success post-graduation, but LGBT students are often excluded from these activities due to their queer identities. If the people in a STEM department are uncomfortable with a student being out or speaking about their queerness, they will avoid working with the student, which means the student has less opportunity to participate in study circles, research, and other activities which would normally help retain them. This effectively creates an environment where students are being tasked with managing the emotions of their departments, and if they fail to do so they risk their entire future and careers.

In a series of focus groups and interviews, Cech and Waidzunas [6] discovered some of the specific ways heteronormativity affects students. Heteronormativity is the assumption that all people are heterosexual and fall in line with a social narrative that they will date, marry, and have children with someone of the opposite sex. Covering and passing were also heavy burdens experienced by many students in this study. Covering is making sure their LGBT identity is not known (e.g. switching pronouns about partners) and passing is the ability to have one's LGBT identity be undetected (colloquially known as being clocked). Although they may not face overt discriminatory action, they feel that they must be better students than anyone else to earn the privilege of coming out and being taken seriously. They must compromise their own identities constantly, prove that they are "more of an engineer" than they are gay to even have a chance of being taken seriously. As one interviewee put it: *"If you can't take their sexuality seriously, then you can't take the person who is identifying as it seriously. Therefore, if you don't take someone seriously, why would you take their work seriously?"* Students had to manage not only their own safety, but the feelings of everyone around them to reassure others that queer people are seen as competent, helpful, and safe to be around. Students in this study felt they lost access to resources, opportunities, and networks as a result of this social isolation, and they fear that they ultimately won't be able to succeed once they leave the relatively "liberal" school environment and enter more conservative workplaces.

Students may try to combat this by joining or forming inclusive communities specific to their identities, but even these can be fraught for students with multiple identities. A qualitative study speaking to disabled, LGBT students in STEM [15], finds that identity-specific organizations are often not accommodating to people of color or those who have a disability. This pushes them further to the fringes of departments as they are

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implicitly or explicitly unwelcome on multiple fronts. Departments should be forming and supporting identity-based spaces to help marginalized students connect, but they must also ensure that these spaces are accommodating and receptive to intersecting identities.

Another way LGBT students may try to combat this environment is by “over-achieving” compared to their peers, but this may not be very effective. In a quantitative study, Hughes [11] found that LGBQ students are more likely to participate in undergrad research, but these students still have lower retention rates than their heterosexual counterparts. This points to the idea that using mentorship, research, and other professional development to try and support LGBQ students is not necessarily going to effectively retain students if it is not paired with social supports. Ultimately, students want to be viewed as valuable including their identity, not despite it. As another student from Cech and Waidzunus [15] said; *“Yeah, gays are tolerated. As opposed to an environment that is tolerant, gays are tolerated.”* Tolerance and inclusion are not the same, and STEM departments need to ensure that they are working towards the latter if they want to effectively support their LGBT students.

Queer STEM Faculty and Workforce

While LGBT faculty face many of the same problems of exclusion as students, a more prevalent theme was that of compartmentalization of their identities. Mattheis, Billimora, and Sandekian [4, 14, 18] all found that LGB faculty felt pressured to separate their “professional” and “personal” selves. This was not limited to explicit expressions of their sexuality: one respondent in Patridge [17] relates the story of how a student who was a frequent attendant of his office hours completely stopped interacting with him after seeing a picture of the professor and his male partner on his desk. Billimora [4] draws an analogy to the military’s “don’t ask, don’t tell” policy, with participants reporting that it was safer to pretend they had no life outside of work and actively cover their queerness. They changed their appearance to be more heteronormative, avoided faculty social events where spouses would normally attend, and were generally more isolated from their departments. For transgender scientists this can be even more extreme: in Mattheis [14], one transgender woman discusses living a “double life” where she presents under a different name and gender expression at work than in her personal life. Using expectancy value theory, Cooper et al. [8] found that LGB biology professors were often out to their coworkers, but much less likely to be out to their students for fear of being perceived as less competent or too political. A low “cost” of coming out was not enough motivation, instructors needed to perceive a high benefit to their students as well. This is partially attributed to the rotating nature of classes: coming out is never a singular event for LGBT people, but the constant cycle of coming out every few months is an extra deterrent. This takes a massive toll on these STEM professionals. Instead of putting energy into their research, they must put a large amount of mental and emotional energy into maintaining the covering of their identity, deciding whether it is safe for them to come out, and trying to navigate a professional environment where they must guess whether they would be welcomed or ostracized.

One understudied challenge for LGBT people in the STEM workplace is safety traveling. Olcott and Downen [16] surveyed LGBT geoscientists about their fieldwork experiences: 55% had been in an area where they felt unsafe due to their identity, and 1 in 3 respondents reported refusing fieldwork because of this. While this is specific to geoscientists, other scientists also often need to travel internationally for conferences, collaborations, and experiments. If a country criminalizes queerness, they must either choose not to attend important events or risk jail and possibly death if they are outed while abroad. Additionally, there are many religious universities in the United States with explicit policies against LGBT students and faculty. Organizing conferences at these institutions could create a hostile environment for academics who are already ostracized. Olcott and Downen’s

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study demonstrates a need for research in this area since the exact scope and effects of hostile laws and policies in physics are unknown.

There have been a few large-scale quantitative analyses of LGBT people in the STEM workplace. Cech and Waizundas surveyed 25,000 STEM professionals [5], about 1000 of whom were LGBT. They found that LGBT people were significantly less likely to have career opportunities, sufficient resources, and feel comfortable whistleblowing. They also reported significantly higher rates of professional devaluation, social exclusion, harassment, health and wellness issues, and thoughts or plans of leaving STEM jobs as well as the STEM profession. Cech and Pham surveyed 30,000 STEM professionals in STEM agencies [7] and found similar disparities in workplace experiences. One unique finding from this study, however, is that the levels of explicit bias did not depend on seniority or age. This suggests that younger LGBT people entering the workforce is not improving overall acceptance, seniority does not grant more freedom, and attitudes have not significantly improved over time. While both studies had data on the race, gender, and sexuality of participants, neither includes an intersectional analysis of these factors, instead grouping “LGBT” as a singular factor in opposition to “non-LGBT” and controlling for all else.

Patridge et al. [17] conducted a secondary data analysis of the *2010 State of Higher Education for Lesbian, Gay, Bisexual, and Transgender People* [31], which surveyed over 5,000 LGBT faculty, staff, and students at universities. Their paper explores the 400 faculty who were surveyed and compares STEM faculty to non-STEM faculty. They found that STEM faculty were more likely to be out than in other fields, but that this directly correlated with discomfort in their campuses, departments, and classrooms. The correlation between being out and experiencing more discomfort existed in all fields, but in STEM it was more likely for these faculty to consider leaving their jobs. Due to a small sample size, this paper did not include transgender or asexual people in their analysis. Although not included in the analysis of experiences, the authors did note that while in most fields 0%-2% of respondents identified in the trans spectrum, in STEM this number was 12%.

The LGBT Climate in Physics Report [1] is the most comprehensive survey of LGBT people in in a specific STEM field to date. Many of their findings reflect other papers in this literature review regarding workplace discomfort, experiences of explicit bias, heteronormativity, and social isolation. Notably, they found that transgender respondents reported uneven protection and support from legislation and policies: of overall participants, 30% reported uneven, lacking, or discriminatory practices, while trans respondents characterized their workplaces this way 49% of the time. Their specific challenges include lack of health benefits, safe bathrooms, and co-workers not using their correct pronouns. Another common theme found in the report was a struggle to identify allies and institutional supports. Lastly, trans participants reported a significantly higher rate of exclusionary behavior (49%) than their non-trans LGB peers (19%).

Queer Non-STEM Higher Education Literature

Outside of research on LGBT students, academics, and professionals in STEM there is also a plethora of work on the experiences of LGBT people in higher education and the workplace more generally. Many of these papers support the findings of previous section on the general themes of discrimination, isolation, and need for policy changes to support LGBT people [13, 31, 32], but there are also papers which begin to fill specific gaps in LGBT STEM literature.

In the literature about LGBT people in STEM, several sources have a section or piece of analysis about the specific struggles of people of color. Of the quantitative studies, most found that the number of people of color

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was too low to find statistically significant differences in treatment. Although race was not the primary focus of any qualitative studies, many participants within them report that race plays an extremely significant role in their experiences regarding their sexuality [1, 5, 15]. Outside of STEM, the *2010 State of Higher Education for LGBT People* [31] found that transgender people of color reported experiencing more harassment (33%) than transgender white people (27%) on campus, and LGBT people of color were less likely to be comfortable in their departments than white LGBT people. Patton and Mobley [28, 30] discuss gaps in the treatment of black queer people at HBCUs (Historically Black Colleges and Universities). Patton interviews 6 gay and bisexual men on their experiences as students at HBCUs and finds that the expectations of covering and de-emphasizing their sexuality were amplified at these institutions. Mobley speaks more broadly to the unique challenges at HBCUs; many were founded by religious organizations and have more culturally conservative attitudes towards LGBT people. While both papers point out an important issue, they are limited to a particular identity and their results cannot be extrapolated to the experiences of non-black POC. More research is needed which specifically focuses on LGBT people of color in STEM at all institutions to get a more complete picture.

There is also a lack of focused study on the experiences of transgender students in STEM organizations due to a lower number of participants. Many included studies report that transgender students seemed to experience more explicit bias, greater discomfort, and are generally more marginalized than their cisgender LGB peers [1, 3, 13, 14, 16, 21], but most do not have adequate data to support this. While many studies intend to be about the LGBT community, many only get LG or LGB participants. It is important then to make this distinction clearer in research; while they are inextricably tied, heterosexism and cissexism function differently. Goldberg et al. aimed to capture the experiences of transgender and nonbinary graduate students via a survey [23]. From the 91 responses they found that most students were concerned about their physical and emotional safety on campus, and often experienced peers and faculty deliberately using incorrect pronouns. Interactions with advisors were found to be an important context for experiencing affirmation or invalidation.

Another understudied aspect of LGBT experiences in STEM is that of disability. In a larger study about disabled LGBT college students at one primarily white southern university, Miller et al. found that the experiences of the students in STEM majors were significantly different to warrant further study [15]. Since STEM majors have an overrepresentation of men and white people, there are many organizations catered towards women and people of color designed to support them. However, disabled students reported an exacerbated partitioning of their identities in these spaces, since any structure designed to support one aspect of their identity was not accepting towards other aspects of their identity, and many were physically inaccessible to them. This often left them without any support, as they would be pushed out of these spaces. While extremely insightful, this paper was limited to 6 students at one institution, and it's important to continue this research and expand on it since this seems to be especially prevalent in STEM. In a literature review and discussion on queer, disabled college students, Harley [25] discusses more formal support structures via counseling and disability offices and found that many students were unable to get support as a disabled LGBT person because neither office was sensitive to the other. This again left students unable to get support, since the support they needed did not fit neatly into one office.

LaSala discusses the risks and rewards associated with being an LGBT academic, regardless of whether a person does research on LGBT issues [26]. They discuss the burden tokenization puts on LGBT faculty via increased mentorship responsibilities and academic scrutiny, as well as being reduced to being “the gay professor” as one author experienced at his own university. They also noted that if a marginalized population is less than 20% of an organization, tokenism is very likely [36]. In addition to generally increased scrutiny,

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LGBT academics who do LGBT research are susceptible to having that research criticized and perceived as unobjective and not rigorous due to insider bias. They recommend combating this by being especially mindful when writing methodology sections. According to LaSala, LGBT research is always going to receive disproportionate pushback because challenging heterosexism can be easily perceived as criticizing specific heterosexual colleagues, and it is questioning something so foundational to social interaction that it will make even the most liberal-minded colleagues uncomfortable and hesitant to accept this work.

Being an LGBT lecturer has similar risks. One study [33] conducted an experiment where a graduate student gave a guest lecture on “cultural influences on the communication process” to 8 sections of a communications class as a part of a fictional hiring process, and students were asked to rate his lecture, competency, and performance. Every lecture was the same, including the introduction given by the professor of the class, with the only difference being in half of the lectures he briefly alluded to his partner “Jennifer” and in half he referred to his partner “Jason.” The survey also had two free response sections: one asking if they had positive comments for the speaker, the other asking if they had critical feedback for the speaker. There were almost four times as many responses to the critical feedback section for the “gay” instructor, and many students commented that he seemed overly biased, he made them feel guilty, and that he seemed overly pushy and “flamboyant”. 93% of students said they would “unquestionably” hire the straight instructor, 8% said they would definitely hire the gay instructor. Another study attempted to faithfully repeat this experiment in 2018 with just the quantitative survey items [22] but did not find students rated the professors differently in credibility. However, the authors note that this study was smaller and held at a university with a very different demographic set than Russ. While this may be inconclusive, this highlights the potential dangers to LGBT instructors who want to come out.

Policy Implications

In order to reduce the harms caused by the STEM culture on LGBT persons, it is critical that departments and institutions seek to clearly include LGBT persons in their communities. This means ensuring: (1) LGBT persons are included in all diversity and inclusion efforts, (2) the adoption of gender neutral language to recognize the variety of gender identities people hold, (3) providing structured mentoring and networking opportunities for students, staff, and faculty, that specifically include LGBT persons, (4) creating safe spaces for LGBT people that are accommodating to intersectional identities such as having a disability, (5) inviting openly LGBT speakers to campus to demonstrate community representation in STEM fields, and lastly (6) hiring LGBT staff and faculty. These are not the only possible approaches to secure LGBT inclusion, of course, but they are a strong starting point for further conversation. A recent 2018 best practices guide for LGBTQ+ inclusion in physics and astronomy offers more solutions and ideas [35].

Future Research

One overarching critique of the work presented here is that it is almost all framed with a deficit perspective, meaning that LGBT persons are seen as having a worse or negative experience compared to their normalized non-LGBT peers. This work is foundational and important, but would be greatly augmented by research that looks at queerness, and being LGBT, as a positive resource rather than an identity that causes continual (and very real) challenges. It is important that our various identities are also reified as aspects both important and uplifting to ourselves and careers. Consequently, further qualitative work should deeply engage in how our scientists benefit from their queer identities, and how this shapes their careers and scientific findings.

Conclusion

The literature discussed here clearly demonstrates an uneven academic and workplace terrain for LGBT scientists and STEM students. Faculty, students, and professionals must navigate identities that are often seen as external, and sometimes contradictory, to the fields in which they work. This, and other compounding issues, leads to career isolation, decreased access to professional development and mentors, and the possible derailing of STEM degree pursuit and professional advancement.

The growing literature on LGBT STEM issues serves as an important entrance into understanding intersectional issues in STEM. Many LGBT persons are also people of color, have disabilities, and hold gender identities not well represented in their fields. To truly understand the experience of LGBT persons in STEM it is necessary to also investigate these other identities. This review will come at a nascent time in the development of this literature and will be able to offer insights and ideas for further studies and interested advocates.



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