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REVIEW ARTICLE

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A systematic review of differences for disabled students in STEM versus other disciplinary undergraduate settings

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Abstract

Background: Engineering education and other discipline-based education researchers may motivate their work with claims that STEM (science, technology, engineering, and mathematics) norms and culture are unique, thus requiring focused study. As research on disabled students gains momentum in engineering education, it is important to understand differences that limit generalizability of prior work in other disciplines to STEM.

Purpose: What do studies document as differences between STEM and non-STEM settings that impact disabled undergraduates, and to what extent are these studies using asset-based perspectives of disability?

Scope/Method: This systematic review identified US studies that compared STEM to non-STEM disciplines in regards to disabled undergraduate students. The qualifying studies, published during 1979–2023, comprise 22 journal articles and 15 doctoral or master's theses. Most studies used quantitative methods ($n = 28$).

Results: Of the 37 qualifying studies, 20 instructor studies provided moderate evidence that STEM instructors are less willing or less knowledgeable about how to support disabled students through accommodations or course design. We highlight a small number of student studies identifying assets of disabled students, although most took a deficit view by comparing disabled student experiences to an able-bodied norm. Few studies emphasized the structural characteristics of STEM such as culture and educational practices that contribute to socially constructing disability by acting as barriers that disable students.

Conclusions: More work is needed to examine instructor actions beyond their intentions and attitudes toward disabled students. Critical and asset-based perspectives are needed in future study designs that center disability to uncover systemic barriers and identify assets disabled students bring to STEM.

The opinions are those of the authors and do not necessarily reflect those of the NSF.

KEYWORDS
disability, faculty, STEM, students with disabilities, systematic review, undergraduate

1 | INTRODUCTION

Each year, an increasing number of disabled students enter postsecondary education systems that were not designed with their accessibility needs in mind (In this article, we use the language of "disabled students" to emphasize our social perspective on disability which posits that students are disabled by inaccessible environments [Oliver, 2013]. We acknowledge that disability terminology is contested, with strong personal preferences which may change depending on the setting [Lister et al., 2022].). At 17% of science, technology, engineering, and mathematics (STEM) majors (NCES, 2022), disabled students are quickly becoming one of the largest marginalized groups in higher education (Ngo & Sundell, 2023). At last count, research on disability represented less than 1% of the articles in top higher education journals without an explicit disability focus (Peña, 2014). Our lack of research-based knowledge on how to support disabled students is just one of many barriers our systems have created for these students.

Education researchers, including those who identify with engineering and other STEM disciplines, conduct research on STEM education for a number of reasons, including

- concern for the future of the profession and the engineering and science workforce;
- concern for a science-literate citizenry who will support sustainability of the planet; and
- concern for equitable access to high-paying, secure employment that may also contribute to upward social mobility.

In addition to critiquing systems and practices that limit these workforce, equity, and literacy goals, engineering education researchers are also motivated to change educational systems to improve student outcomes such as learning, graduation rates, and employment. Ableism in engineering is one limitation that can lead engineering students and employees to leave their program or consider leaving their job (Cech, 2023). Here, we define ableism as "stereotyping, prejudice, discrimination, and social oppression toward people with disabilities" (Bogart & Dunn, 2019). At the postsecondary level, changes to educational systems means changes to instructor and institutional policies and practices. A main audience for engineering higher education research is faculty in engineering disciplines, which explains why a substantial proportion of STEM higher education research is conducted by discipline-based education researchers (DBERs) embedded in engineering and STEM colleges and departments.

Engineering faculty can be skeptical of education research conducted on students from disciplines outside their own (Borrego, 2007). Discipline-based education researchers—ourselves included—sometimes look to differences between STEM and other disciplines as motivation to study experiences and outcomes for engineering or STEM students, including disabled students. Much of the literature suggests that disabled college students face similar attitudes and challenges regardless of discipline. Yet, the nature of STEM courses, including laboratory formats and reliance on exam-based assessment, suggests that disabled students experience STEM courses differently from those in non-STEM disciplines. Therefore, we conducted a systematic literature review to investigate the following research questions (RQs):

> RQ1: What differences have been identified in the literature between STEM and non-STEM disciplinary experiences that impact the success of disabled students?
> RQ2: To what extent are research studies employing an asset-based perspective in comparing disabled student experiences in STEM and non-STEM disciplines?

We argue that the literature comparing STEM and non-STEM learning environments for disabled students in postsecondary education is sufficiently developed and dispersed among disciplines to warrant the type of synthesis and weighing of evidence a systematic review provides. Systematic reviews are appropriate when a literature base exists but researchers and practitioners do not know the overall conclusions that can be drawn from it (Gough et al., 2012; Petticrew & Roberts, 2006). The benefits of a systematic review include identifying important gaps in the literature, future directions for research, and recommendations for practice (Borrego et al., 2014).

Further, our initial scoping review of the literature on undergraduate STEM students with disabilities (Borrego et al., 2025) identifies gaps in the engineering education literature that can be informed by studies conducted across STEM disciplines and within other STEM disciplines, including how to support students with blindness or visual impairment, learning disabilities, and developmental, intellectual, and cognitive disabilities. It would be irresponsible to ignore this STEM education literature as uninformative to engineering education researchers and practitioners.

1.1 | Positionality

We are engineers, engineering and science instructors, a librarian, and graduate students at a research-extensive institution in the United States. All of us have previously participated in evidence synthesis projects. Our decision to conduct this review arises from our experiences with disability in STEM, whether as disabled individuals and students, instructors of disabled students, or as support for researchers seeking disability-related resources in STEM contexts.

Four of us have direct experience as disabled students in STEM, and three have attained engineering degrees. We leverage these experiences to design this review, focusing on how STEM, particularly engineering, may differ for students with disabilities compared to other disciplines. We aim to explore whether these differences influence the ways we encourage best pedagogical practices.

1.2 | Disability and undergraduate accommodations

Upon entering postsecondary learning environments, disabled students face many changes from their K12 learning environments. Across academic disciplines, these students find themselves navigating brand new accommodations and support systems, all while adapting to college life (Friedensen et al., 2021). In the United States, navigating college as a disabled student involves grappling with distinct legal requirements, such as IDEA (The Individuals with Disabilities Education Act, 2004) and ADA (Americans with Disabilities Act, 1990), that often differ in presentation and protections from those experienced by students in previous stages of their academic career (Goodwin, 2020). While students with formal diagnoses may still work with disability service offices to offer tailored accommodations, these professionals often have limited contact with instructors and the students themselves (Pfeifer et al., 2021). It is crucial to recognize that such resources are exclusive to students with formal diagnoses and that many barriers exist to obtaining documentation required by disability services offices (Annamma et al., 2013; Stumbo et al., 2011). Those without such documentation encounter significant challenges in adapting to changing environments (Goodwin, 2020) and meeting evolving academic expectations. In contrast with their previous teachers, postsecondary instructors are rarely well versed in disability best practices (Moriarty, 2007) or universal design (Schreffler et al., 2019) that might preclude the need for individualized accommodations.

1.3 | Undergraduate science and engineering settings

Several characteristics of engineering and other STEM disciplines may make their courses the least accessible to undergraduates. Undergraduate courses tend to value hard work and quick answers, regular examinations with strict time limits, and expectations of group work in both discussions and projects (Gin et al., 2020; Pfeifer et al., 2021). STEM degree requirements—especially engineering—often include a core set of courses and content that cannot be avoided, and in some departments, instructors who cannot be avoided (Bettencourt et al., 2018). In other words, there may be less flexibility—both culturally and structurally—in STEM courses. Due to ableist norms that discourage students from asking for accommodations or help (Goodwin, 2020), undergraduate students pursuing STEM fields including engineering demonstrate a lower likelihood of utilizing accommodations in their courses compared to those in non-STEM disciplines (Lee, 2014). In labs specifically, the learning environment, built environment, and task execution are all sources of barriers for disabled science and engineering students (Jeannis et al., 2018). Prior literature indicates that the environmental and psychological conditions and barriers for students with disabilities in engineering classrooms largely align with those in other STEM settings.

1.4 | Accommodations in STEM courses

STEM faculty may make accommodations processes even more onerous. Students report discouraging experiences with STEM faculty, many of whom lack empathy (Bettencourt et al., 2018). STEM instructors tend to view their discipline as challenging and the experience of completing a STEM major as inherently difficult (Bettencourt et al., 2018), requiring hard work to which students may not be sufficiently accustomed (Wrage, 2017). These instructors may be suspicious of students using accommodations as an unfair advantage (Bettencourt et al., 2018; Wrage, 2017), and they may view granting requested accommodations as shirking their responsibility to prepare students for challenging careers (Bettencourt et al., 2018). The large enrollments in many introductory STEM courses conspire against both course redesign and individual accommodations (Bettencourt et al., 2018; Friedensen et al., 2021). Finally, in the absence of formal accommodations, physics faculty disagree about what types of students should be accommodated (Scanlon & Chini, 2019).

1.5 | Results from prior reviews

The experiences of disabled students in higher education have been studied for decades. This research spans academic disciplines and formats including dissertations, conference papers and journal articles, which warrants reviews and syntheses of prior research. For example, recent reviews focus on assistive or educational technology for disabled students (e.g., Alsalamah, 2020; Fernández-Batanero et al., 2022; Genç et al., 2019; McNicholl et al., 2021). A limited number of prior reviews focus on disabled students in STEM disciplines. Schreffler et al. (2019) identified just four articles using universal design for learning (UDL) in postsecondary STEM settings. Jeannis et al. (2018) focused on physically disabled students accessing science and engineering laboratories.

Researchers outside the STEM disciplines are commonly the ones to collect comparative data that would inform the differences between the STEM and non-STEM disciplinary experiences of disabled students. For example, Rao's (2004) review identified several studies reporting disciplinary differences in faculty attitudes toward disabled students, many of which are included in the present review. Conducted 20 years ago, Rao's review is due for an update, and the topic would benefit from systematic search and review techniques developed and popularized in the past two decades. Systematic review practices in engineering education have advanced substantially in recent years. Due in part to a recent *JEE* special issue (Adescope, 2021), there is greater adherence to PRISMA guidance including preregistration of protocols, use and documentation of multiple databases, and deeper discussion of the limitations and potential biases of systematic reviews.

Specifically, systematic review is a good fit for the present topic because it "uses explicit, systematic methods to collate and synthesize findings of studies that address a clearly formulated question" (Higgins & Green, 2009, p. 3; Page et al., 2021). Further, systematic reviews appraise and synthesize the results of a systematic search to inform practice and research (Munn et al., 2018). We might frame the practice as emphasizing differences between STEM and non-STEM disciplines when it comes to undergraduate students with disabilities. Due to some survey scales being used in multiple studies, we can make a few direct comparisons. We also identify gaps and directions for future research.

2 | THEORETICAL PERSPECTIVE: SOCIAL AND MEDICAL MODELS OF DISABILITY

The way researchers and educators frame disability can actively perpetuate misconceptions and harm toward disabled people. In this article, we take an asset-based view toward disabled students in placing the burden of change on an unfair system rather than on disabled students themselves. Specific to disability, such an asset-based perspective is referred to as the *social model of disability*. In a similar vein to scholarship on racial equity that draws attention to how racism is a systemic, structural, and societal issue (Bonilla-Silva, 2015), the social model of disability focuses on how ableism is structural rather than interpersonal and how disabled people are pathologized (Gernsbacher, 2017). The social model of disability places the emphasis on structural and systemic aspects within society that prevent people from fully participating (Oliver, 2013). An assets-based perspective may critique systems and institutions as inaccessible and/or focus on the positive attributes of students, their resources, and their contexts (Braun et al., 2017; Harper, 2010). An example is universal design innovations such as curb cuts or captioning by default, which benefit more than those identifying as disabled and remove barriers that effectively disable some people and not others.

Unfortunately, discussions concerning disabled students are often framed in deficit terms of what these students lack compared to their non-disabled peers. This deficit perspective aligns with the *medical model of disability*. Focus on deficits and gaps when comparing disabled persons to an able-bodied norm implicitly presumes that *individuals* must change or be changed to fully participate in education or society (Annamma et al., 2013). Relying on success criteria derived from a system not designed for disabled individuals inherently places them at a disadvantage. Further, the stigma associated with these conceptualizations of disability can serve as marginalizing factors, even in efforts that are meant to help disabled students (Artiles, 2019). For example, the system of academic accommodations is grounded in a deficit medical model. Researchers and practitioners following a medical model may focus on providing "supports" that disabled people supposedly lack to participate in education the same ways as non-disabled peers (Triano, 2000), without questioning why our systems require so many accommodations in the first place. Such deficit perspectives and medical models are often implicit. However, as with most ways of thinking about identity, asset-based and deficit-based perspectives exist on a spectrum rather than as a binary. Some scholars blend both asset and deficit perspectives in their work, thus presenting what can be considered a neutral perspective on disability. While scholars using an asset-based approach might still identify the challenges disabled people face, they refrain from placing the burden of these challenges on the individual. Scholars taking a neutral perspective may recognize these challenges without attributing responsibility to either the disabled individual or the environment/system.

We apply these contrasting asset-based, neutral, and deficit perspectives on disabled students to address our second research question (to what extent do studies demonstrate an asset-based perspective). Adopting an asset-based lens and minimizing the preoccupation on "fixing" individuals allows efforts to enhance student success to more effectively address the systemic contexts that fundamentally influence success. Yet, we found many studies guided by an implicit deficit lens. To improve future research, we demonstrate the ways deficit approaches have permeated studies motivated by a desire to help disabled students and highlight a few exemplars of asset-based approaches to comparing the experiences of disabled students in STEM and non-STEM disciplines.

3 | METHODS

We followed standard methods for conducting systematic reviews in engineering education as laid out by Borrego et al. (2014) and elaborated by Phillips et al. (2023) and report our procedures consistent with PRISMA guidelines (Page et al., 2021) and the PRISMA-S supplement (Rethlefsen et al., 2021). This systematic review analyzes 37 qualifying studies identified through multiple complementary strategies. First, we identified a subset of studies from a scoping review of literature on disabled STEM undergraduates conducted in collaboration with a librarian and preregistered with Open Science Framework 2022 (Chasen 2022). As appropriate for the relationship between scoping and systematic

TABLE 1 Inclusion criteria.

Inclusion criteria **Initial scoping review**	**Inclusion criteria** **Current systematic review**
1. Population: STEM undergraduate students with disabilities, including data from STEM instructors if relevant. 2. Setting: undergraduate STEM settings. 3. Publication type: Includes news items, profiles of individuals, reports, theses/dissertations, conference papers, and journal articles. 4. Date range: Published in 2005 or later, to coincide with the 2004 reauthorization of the Individuals with Disabilities Education Act (IDEA). 5. Country: Sources based on educational settings or students in the United States.	1. Population: Current or prior undergraduate students, and/or instructors of undergraduate students. 2. Setting and Country: Set in a higher education setting in the United States, because laws and definitions of disability vary markedly across national contexts. 3. Publication type and language: Original studies published in peer-reviewed journals, dissertations, and conference papers were included. Studies must be published in English. 4. Disciplines: Must include data from both a STEM and non-STEM population comparing the two populations. 5. Focus: Discussion of disability-related application or population and describe a difference between STEM and non-STEM. Papers were included if the authors asserted that there is a difference between STEM and non-STEM, whether the result is statistically significant or not.

reviews (Munn et al., 2018), the scoping review informed our decision to pursue the current analysis of differences between STEM and non-STEM disciplines.

3.1 | Inclusion and exclusion criteria

The inclusion criteria for the initial scoping review and the current systematic review are listed in Table 1. The exclusion criteria for the current systematic review were as follows:

1. Wrong publication type: Literature reviews and nonempirical gray literature (reports, new items) were excluded.
2. Not USA: None of the data presented were collected from US students or at US institutions.
3. Not in English: Main text is not accessible in English.
4. Not STEM: Our definition of STEM includes engineering, mathematics, and natural and physical sciences. In our initial screening of sources, we excluded papers with health sciences or psychology as the only STEM disciplines. However, the sources we review used a variety of sampling strategies and classification systems for analyzing data by academic discipline, and a few did not share the details of specific disciplines appearing in their STEM categorization. Since our definition of STEM includes engineering, mathematics, and the natural and physical sciences, it differs from some authors' definitions. Therefore, we included studies as long as they aligned with at least one STEM discipline in our definition. In the results tables, we provide detailed information to clearly indicate the academic disciplines being compared. We also note that focusing solely on engineering was impractical due to the number of studies that either did not specify the STEM disciplines involved or combined engineering with other STEM fields. Consequently, a broader search was necessary to gain insights for engineering education research and practice.
5. No differences between STEM and non-STEM: We excluded studies that tested for differences but found none, because it was impractical to thoroughly identify all such studies.
6. Duplicates: If dissertation results were also published in a qualifying paper or set of papers, we excluded the dissertation.

3.2 | Information sources and search strategy

We searched seven databases, chosen for strengths in education, STEM disciplines, types of literature included, and interdisciplinary nature. Databases searched are Academic Search Complete (EBSCO), APA PsycINFO (EBSCO), Education Source (EBSCO), ERIC (EBSCO), SocIndex (EBSCO), Proquest Dissertations & Theses, and Web of Science: Core Collection. Initial searches were run on March 7 and 8, 2022 and updated October 19–22, 2023. Through an iterative process, we developed the search terms and protocol as shown in the Appendix. We searched keywords across four domains. Each domain covered a different search criterion designed to identify articles that contained at least one term in each of the four domains: (i) reference to disability or ableism, (ii) reference to a specific STEM domain, (iii) reference to a class or educational setting, and (iv) reference to college or higher education. The input of each sphere was separated by the Boolean term "AND" to ensure the inclusion of at least one term from each sphere in every search hit. This search strategy was internally reviewed by a non-involved librarian focused in education prior to retrieval of results.

The protocol identified 12,920 sources, and 3580 duplicates were removed using the Systematic Review Accelerator's Deduplicator tool and hand deduplication. At least two authors screened each of the remaining 9340 items. This screening resulted in 409 qualifying sources for a preliminary scoping review, presented in detail elsewhere (Borrego et al., 2025).

One author extracted a subset of potential sources from the scoping review set related to comparing STEM and non-STEM disciplines. She examined every entry in the spreadsheet of extracted study details, specifically disciplines studied, study purpose or research questions, independent variables (e.g., discipline), and main findings, referring back to full texts for clarification as necessary. We then used a forward and backward citation searching method to find additional studies citing and cited by these potential sources. All potential studies as well as those identified through citation searching were then carefully assessed by at least two authors for inclusion.

3.3 | Data collection: Coding and quality assessment

In consultation with the entire team, the first author developed a Google form to extract relevant data including specific STEM and non-STEM disciplines compared, disability type studied, research question/aim, variables, study participants, data collection, findings, and intersectionality. Selection and extraction processes for data items were based on components of the 2020 PRISMA checklist (Page et al., 2021) such as time points, type of analysis, institutional characteristics, and participant characteristics. Four authors divided up the 37 studies and completed the coding form independently. Using this coding form data as a starting point, one author compiled the results tables, while the other authors drafted results text. Thus, multiple authors referred back to the full texts multiple times to clarify and communicate findings. We met weekly to discuss clarifying questions related to coding, draft and organize results tables, weigh the strength of evidence for our conclusions, and edit our writing.

We also worked together to group the qualifying studies as they are presented in multiple tables and Section 4. First, we separated studies of instructors from studies of students. Within instructor studies, most focused on instructor willingness to accommodate, knowledge of disability laws and resources, attitudes toward disabled students, or a combination of these. Results synthesizing instructor studies are presented according to these outcomes of interest. Student studies spanned a much broader range of sample sizes, comparisons between groups of students, and outcomes of interest. Consistent with our theoretical perspective and research questions, we categorized each student study as deficit-based (i.e., comparing disabled students to an able-bodied norm), neutral (i.e., neither deficit nor asset), or asset-based (e.g., identifying assets of disabled students navigating STEM). All four coding authors discussed and agreed on the categorizations. Our operationalization of deficit studies, then, was those focused on student characteristics (Winterer et al., 2020), most often comparing a disabled and non-disabled group. We relied on the findings of the studies instead of the intention and framing of the authors. We recognize that identities—such as identifying as disabled—are fluid, yet we assert it is unjust to expect students to change these identities as an implication of such deficit studies.

Since the qualifying studies varied widely in their methodological approaches and centrality of disciplinary comparisons to their research questions, we did not assign quality scores to the individual studies. Instead, we provide details of study design, sample size, reported differences, and *p*-values in the tables listing the studies. We acknowledge *p*-values as imperfect indicators of the strength of evidence (Wasserstein & Lazar, 2016), yet we include them in the tables where available following traditionally used ranges for reporting as the most meaningful way to consistently summarize the findings. Within each narrative results section, we weigh the strength of evidence in relation to each outcome. We summarize strength of evidence and directions for future work in Section 5.

4 | RESULTS

Figure 1 is a PRISMA chart illustrating the search and screening process (Page et al., 2021), and Table 2 presents an overview of the 37 studies included in the review. These studies represent a range of years, publication types, and foci. The studies' publication dates span the years 1979 to 2023. The set includes 22 journal articles, 14 doctoral dissertations, and 1 master's thesis. Conference papers were not deliberately excluded; however, no STEM versus non-STEM comparisons were identified among the screened studies, despite the inclusion of conference papers in the preliminary scoping review. There are 17 studies with students as participants and 20 studies with instructors or faculty as participants. There are 28 studies that use quantitative methods, 4 that use qualitative methods, and 5 that use a mixed-methods approach. There is a wide range of disability categories used in the studies and a wide range of definitions of STEM and non-STEM across the studies.

4.1 | Instructor studies

Studies focused on instructors explored similar and related outcomes including attitudes toward disabled students, willingness to provide accommodations, and accessible instructional practices. Instructor attitudes toward disabled students can significantly influence their willingness to accommodate, shape classroom practices, and impact overall perceptions, ultimately determining the inclusivity and accessibility of the learning environment. They relied heavily

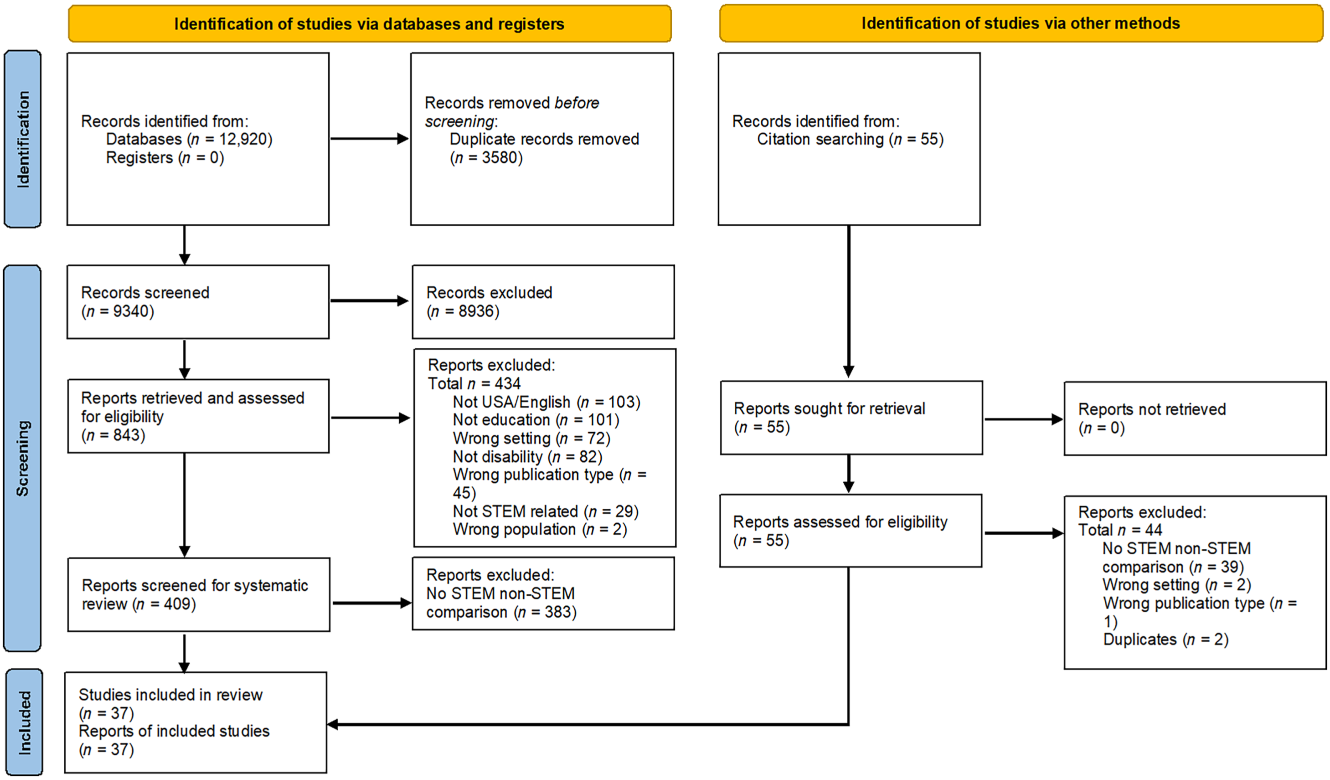

FIGURE 1 PRISMA-format diagram of search and screening process and results. PRISMA terminology is "reports," but we use "sources" in the current text.

on instructor surveys, with only a few qualitative interview studies (Embry & Mcguire, 2011; McDowell, 2020) and document analyses of syllabi (Barnard-Brak & Lan, 2010) and instructional materials (Embry & Mcguire, 2011).

4.1.1 | Instructor attitudes toward disabled students

The five studies of instructor attitudes toward disabled students are listed in Table 3. Three studies used the "Attitudes Toward Treatment of Disabled Students" (ATTDS) instrument, which allows for some comparison of trends over time. ATTDS comprises 32 items scored on a 5-point Likert scale. Higher scores indicate more positive attitudes. Studies report combined scores out of a total possible 160. In 1979, Fonosch reported a mean score of 96.05 (60%) for all faculty surveyed. Then in 1987, Schoen et al. reported 114.7 (72%) for all faculty and 110.45 (70%) for engineering faculty surveyed. Finally, in 1998, Lewis added a few items for a total of 180 possible points. All faculty averaged 125 (70%), and computer and engineering faculty 112 (62%). We note that in the original scale development, Fonosch (1979) motivates her work by citing Section 504 of the Rehabilitation Act of 1973, suggesting that instructor attitudes may undermine institutional efforts at compliance. Lewis (1998) builds on this motivation in citing the Americans with Disabilities Act of 1990 as a relatively new legislation now requiring accommodations, which again may be undermined by faculty attitudes. Taken together, these results indicate some increase over an 18-year period in faculty attitudes about students with disabilities that aligns with, if cannot be fully attributed to, accessibility legislation milestones.

McGee (1989) adds to this discourse specifying more positive attitudes from non-STEM faculty and administrators toward the ability of blind, learning-disabled, and paraplegic students. One study (Williamson, 2000) adds that these negative attitudes from STEM faculty manifest in their agreement with the questionnaire statement, "The needs of students with disabilities can best be served through special, separate programs" (p. 59) clarified in another item as opposed to "a regular classroom" (p. 88). Williamson's questionnaire was adapted from a study of K12 teacher attitudes about mainstreaming special needs children. This issue is far less relevant in higher education.

TABLE 2 Summary of included studies.

Author(s), year	Sample	Population	Method	Disciplinary differences outcomes (RQ1): Accommodation or instructional practice	Knowledge or attitude toward disability	Engagement, identity, self-efficacy	Career and major decision making	Academic performance	Theoretical perspective on disability (RQ2)
Alghazo, 2008	MI	Instr	Quant	×	×				N
Barnard-Brak & Lan, 2010	SI	Instr	MM	×					N
Bourke et al., 2000	SI	Instr	Quant	×					N
Brockelman, 2005	SI	Instr	Quant	×					N
Carter, 2021	SI	St	Qual	×	×		×		A
Castillo, 2020	SI	St	Quant					×	D
Chiu et al., 2019	SI	St	Quant	×				×	N
Dallas et al., 2014	SI	Instr	Quant	×					N
Dishauzi, 2016	SI	St	Quant			×	×		N
Embry & Mcguire, 2011	SI	Instr	Qual	×	×				N
Fonosch, 1979	MI	Instr	Quant		×				N
Gelbar & Madaus, 2021	SI	St	Quant	×					N
Gormally & Inghram, 2021	MI	St	MM				×		A
Groah et al., 2017	MI	St	MM				×		D
Hanna, 2016	MI	St	Quant			×			N
Lee, 2022	MI	St	Quant				×		N
Lee, 2014	MI	St	Quant				×		D
Lewis, 1998	SI	Instr	Quant	×	×				N
Lombardi & Murray, 2011	SI	Instr	Quant	×	×				N
McDowell, 2020	SI	Instr	Qual	×					N
McGee, 1989	SI	Instr	Quant		×				N
McGinty, 2016	SI	Instr	MM	×					N
Mitchell, 2007	SI	St	Quant					×	N
Monagle, 2015	MI	St	Quant	×					N
Murray et al., 2008	SI	Instr	Quant	×					N
Nelson et al., 1990	SI	Instr	Quant	×					N

(Continues)

TABLE 2 (Continued)

Author(s), year	Sample	Population	Method	Disciplinary differences outcomes (RQ1): Accommodation or instructional practice	Knowledge or attitude toward disability	Engagement, identity, self-efficacy	Career and major decision making	Academic performance	Theoretical perspective on disability (RQ2)
Parks	SI	Instr	Quant	×					N
Price, 2018	SI	Instr	MM		×				N
Rao & Gartin, 2003	SI	Instr	Quant	×					N
Safer et al., 2020	SI	St	Quant				×	×	N
Schoen et al., 1987	SI	Instr	Quant		×				N
Shattuck et al., 2014	MI	St	Quant			×			N
Skinner, 2007	SI	Instr	Quant	×					N
Stumbo et al., 2011	SI	St	Qual	×	×	×			N
Wei et al., 2014	MI	St	Quant					×	N
Wei et al., 2017	MI	St	Quant				×		N
Williamson, 2000	SI	Instr	Quant		×				N

Abbreviations: A, asset-based; D, deficit; Instr, instructors; MI, multi-institution; MM, mixed methods; N, neutral (neither asset nor deficit); Qual, qualitative; Quant, quantitative; SI, single-institution; St, students.

TABLE 3 Instructor studies, $n = 20$ unique studies.

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
Attitudes toward disabled students			
Attitudes toward disabled students (Fonosch, 1979)	MANOVA of 394 questionnaire responses	Attitudes toward disabled students were lowest for engineering, followed by business and natural sciences. The difference between engineering (lowest) and social sciences (highest) was statistically significant*. Attitudes toward disabled people were not significantly different but lowest for natural sciences followed by humanities/fine arts and engineering.	STEM = engineering, natural sciences Non-STEM = business, social sciences, humanities/fine arts
Attitudes toward disabled people (Lewis, 1998)	ANOVA of 689 questionnaire responses	Computer science and engineering faculty had less positive attitudes toward people with disabilities than faculty in other disciplines*.	STEM = computer science and engineering Non-STEM = arts and sciences, education, and the health sciences
Attitudes about serving disabled students (Williamson, 2000)	ANOVA of 71 questionnaire responses	Arts and sciences faculty had highest agreement with "The needs of students with disabilities can be best served through special, separate programs."*	STEM = arts and sciences Non-STEM = education and business
Attitudes toward disabled students (McGee, 1989)	ANOVA of 500 questionnaire responses	Non-STEM faculty and administrators had more positive attitudes toward the ability of blind***, learning disabled*, paraplegic**, and quadriplegic** students.	STEM = hard classification per Biglan (1973) Non-STEM = Biglan's soft classification
Attitude toward and treatment of disabled students (Schoen et al., 1987)	Chi-squared comparison of 270 questionnaire responses	Faculty in STEM and business had lowest overall scores and faculty in non-STEM disciplines had highest overall scores for attitude toward treatment of disabled students**.	STEM = engineering, science Non-STEM = education, liberal arts, forest and recreation resources, architecture
Willingness to accommodate			
Willingness to accommodate students with learning disabilities (Nelson et al., 1990)	ANOVA and effect size of 103 questionnaire responses	Arts & Sciences faculty were less willing to make instructional accommodations*, assignment accommodations*, exam accommodations, and grant special assistance (e.g., proofreaders) compared to Education faculty. Arts & Sciences faculty were more willing to grant assignment accommodations than Business faculty.	STEM = college of arts & sciences Non-STEM = college of education, college of business
Willingness to accommodate students with learning disabilities (Lewis, 1998)	ANOVA of 689 questionnaire responses	Engineering and computer science faculty were less willing to provide instructional accommodations than Arts & Sciences and Health Sciences faculty*** and less willing to provide exam accommodations than Education and Arts & Sciences faculty**.	STEM = computer science and engineering Non-STEM = arts & sciences, health sciences, and education
Willingness to accommodate disabled students	ANOVA and t-tests of 245 questionnaire responses	Engineering faculty were less willing to provide accommodations than faculty from all other disciplines combined***.	STEM = engineering Non-STEM = education and professional health;

(Continues)

TABLE 3 (Continued)

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
(Rao & Gartin, 2003)			agriculture, food, & life sciences; arts & sciences; business; architecture; law
Willingness to provide accommodations (Skinner, 2007)	Means of 253 questionnaire responses (no significance testing)	Math & science faculty had less overall willingness to provide accommodations than education but more than business faculty. Math & science faculty agreed more strongly with allowing students to take alternative courses to fulfill math and language requirements than business but less strongly than education or humanities and social sciences.	STEM = math and science Non-STEM = business, education, humanities and social sciences
Willingness to accommodate students with learning disabilities (Murray et al., 2008)	Exploratory factor analysis and correlations of 192 questionnaire responses	STEM faculty were more willing to provide exam accommodations than faculty in commerce and liberal arts and sciences*. STEM faculty were more willing to provide teaching accommodations than liberal arts & sciences faculty**. Instructors outside of the school of education, as compared to those in education, had significantly less knowledge of accommodations* and are less likely to personally invest in supporting students with learning disabilities.	STEM = computer science, telecommunications and information systems Non-STEM = liberal arts & sciences, commerce
Barriers to providing accommodations, including knowledge and attitudes			
Ability to provide accommodations (Bourke et al., 2000)	ANOVA of 162 questionnaire responses	STEM faculty reported greater difficulty than others in providing an alternate form of an examination to students with learning difficulties.	STEM = college of natural science and mathematics Non-STEM = college of arts
Knowledge of disability law (Price, 2018)	*t*-Tests of 54 questionnaire responses	STEM faculty had less familiarity with Section 504 of the Rehabilitation Act of 1973 than faculty in non-STEM areas*.	STEM = agriculture, engineering, pharmacy, science, health sciences, architecture, environment, and nursing Non-STEM = education, law, social sciences arts and humanities, and business
Fairness of accommodations (Alghazo, 2008)	Multiple linear regression on 293 questionnaire responses	STEM faculty rated several accommodations as less fair than non-STEM faculty rated those accommodations.	STEM = non-arts (including sciences, education, business and engineering) Non-STEM = unspecified
Beliefs about inclusion and implementing Universal Design for Instruction (Embry & Mcguire, 2011)	interview, document analysis, and observation of five teaching assistants	"Participants from STEM disciplines expressed contradictory views on inclusion, expressing a desire to include everyone but also acknowledging difficulties in including certain students, possibly influenced by their teaching contexts" including "required course pace."	STEM = math and psychology Non-STEM = business

TABLE 3 (Continued)

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
Perceived effectiveness of accommodations (Brockelman, 2005)	*t*-Tests on 107 questionnaire responses	Engineering faculty rated giving students extra time on exams as more effective than non-STEM faculty rated it.	STEM = engineering Non-STEM = education, communications, fine and applied arts
Faculty attitudes and perceptions toward students with disabilities (Lombardi & Murray, 2011)	MANOVA of 289 questionnaire responses	Arts and sciences faculty scored lower than education faculty on multiple scales: Fairness in Providing Accommodation*, Knowledge of Disability Law***, Adjustments to Course Assignments**, Minimizing Barriers**, Willingness to Invest Time*, Accessibility of Course Materials***, and Performance Expectations***. Arts and Sciences faculty scored lower than architecture faculty on Minimizing Barriers** and lower than business faculty on Accessibility of Course Materials*.	STEM = arts and sciences Non-STEM = education, business, architecture
Ability to provide accommodations (Bourke et al., 2000)	ANOVA of 162 questionnaire responses	STEM faculty reported greater difficulty than others in providing an alternate form of an examination to students with learning difficulties.	STEM = college of natural science and mathematics Non-STEM = college of arts
Instructional practice			
Disability accommodation statements on course syllabi (Barnard-Brak & Lan, 2010)	Coding and Chi-squared comparisons of 75 course syllabi	Professors in colleges of education were more likely than those in engineering to have more accurate* and longer* disability statements on syllabi. They were also more likely to have made their own syllabus disability statements rather than use a stock version***.	STEM = engineering Non-STEM = education
Universal Design for Instruction (UDI) use and formal accommodations experience (McGinty, 2016)	Factorial ANOVA of 41 questionnaire responses	Among faculty with little formal experience with accommodations, engineering faculty had unusually high agreement that UDI was being practiced at the institution.	STEM = engineering Non-STEM = health and human sciences
Universal Design for Learning use (Dallas et al., 2014)	ANOVA 381 questionnaire responses	Science faculty were less likely to use multiple means of representation in their teaching than those in college of applied sciences & arts*, education***, mass communication & media arts*.	STEM = college of science Non-STEM = colleges of applied sciences & arts, education, and mass communication & media arts
Perceptions of students with mental health concerns (McDowell, 2020)	14 interviews	STEM faculty were generally supportive of students with mental health concerns, but still used exclusive and limiting language. STEM instructors as compared to social science instructors depended on care practices (e.g., "are you okay?") rather than technical training or course design to help students with mental health concerns.	STEM = organic science, mobility science, quantitative patterns Non-STEM = human society, information exchange, creative works

Note: * indicates $p \le .05$, ** indicates $p \le .01$, and *** indicates $p \le .001$.

4.1.2 | Instructor willingness to accommodate

Five studies evaluated instructor willingness to accommodate as a primary outcome, all using surveys, and four of these studies focused on learning disabilities (LD, Table 3). Again, use of a common scale facilitates comparisons over time. Three studies used the same 18-item set of dichotomous items asking whether instructors would or would not provide a specific accommodation. Results were reported in two ways. On a 12-point scale, Lewis (1998) reported subscales that sum to 11.895 for computer and engineering faculty. Then in 2003, Rao and Gartin report a mean for all faculty of 12.12 (SD = 2.98) with engineering faculty at 10.51 (SD = 2.50). This comparison may indicate a slight increase in 5 years. Based on the disciplinary distributions in each study, we estimate that Lewis's sample was at least 54% STEM faculty, and Rao and Gartin's at least 29% STEM (both included colleges of arts and sciences not included in this calculation). Results can also be expressed as a percentage of faculty answering yes to whether they would provide the accommodation. Across the 18 accommodations, three studies (Lewis, 1998; Nelson et al., 1990; Rao & Gartin, 2003), and 5 years, there is little discernible pattern. Most items are surprisingly stable between the three studies, considering different disciplinary distributions of faculty, which translates to significant differences within studies. It is most alarming that some standard accommodations such as giving partial credit for correct computation but incorrect final answer (range 39%–81%), using basic calculators on exams (76%–86%), and providing a detailed syllabus to give students ample time to complete assignments (82%–94%) were highest in the earliest study. Other accommodations such as providing copies of lecture notes and extending deadlines may have increased slightly over time. Some accommodations that have become commonplace were consistently high even 30 years ago: recording lectures (allowing students to record, 98% in all three studies) and providing extra time on exams (82%–93%). As might be expected from studies of faculty in different disciplines, the biggest discrepancies from study to study were in allowing extra credit assignments for the disabled student but not others (range 11%–33%) and three items about allowing proofreaders to assist with vocabulary (27%–67%), grammar (51%–95%), and structure on writing assignments (55%–84%). In sum, the trends are not indicating progress, but they are also muddied by very different distributions of STEM faculty in each study. We note that these studies were clustered within a 5-year period between the Americans with Disabilities Act of 1990 and 2004 reauthorization of the Individuals with Disabilities Act (IDEA).

Across all the studies in Table 3, education faculty displayed greater knowledge of learning disabilities, more willingness to personally invest in students with learning disabilities (Lewis, 1998; Murray et al., 2008), and higher likelihood of accommodation (Lewis, 1998; Nelson et al., 1990) as compared to STEM disciplinary faculty. Similarly, Rao and Gartin (2003) found engineering faculty less willing than faculty from all other disciplines combined to provide accommodations. Skinner (2007) concluded math and science faculty demonstrated less overall willingness to accommodate compared to their counterparts in education but more than business faculty.

Instructors also showed differences in which accommodations they see as effective. In particular, engineering faculty were significantly more likely to rate extended time for exams as more effective than their non-STEM counterparts (Brockelman, 2005). As compared to education faculty, arts and science faculty scored significantly lower on their perceptions about fairness in providing accommodations, making adjustments to course assignments, minimizing barriers, accessibility of course materials, and performance expectations for disabled students (Lombardi & Murray, 2011).

4.1.3 | Barriers to accommodating disabled students

Studies in Table 3 also used surveys to identify several barriers to providing accommodations. College of natural sciences and mathematics faculty encountered challenges in providing alternate forms of examinations to students with learning difficulties (Bourke et al., 2000). Additionally, STEM faculty including engineering, exhibited less familiarity with Section 504 of the Rehabilitation Act of 1973 compared to non-STEM faculty (Price, 2018). Similarly, Lombardi and Murray (2011) found that faculty in education reported significantly more knowledge of disability law than faculty in all other colleges, who all had relatively low baseline knowledge. More research is needed to understand the relationships between instructor training, knowledge of resources, willingness to accommodate, and resulting accessibility behaviors.

Some studies in Table 3 discussed disciplinary differences in willingness to accommodate related to the perceived feasibility of providing certain accommodations while maintaining the integrity, rigor, and curriculum of those fields. Disciplinary assumptions about rigor impacted perceptions about what is fair in providing accommodations, as found by Alghazo (2008); non-STEM faculty more liberally rated accommodations as "fair" compared to their STEM counterparts. Due to the nature of their discipline, and the distinctness of environments such as lab classrooms from those of other disciplines, some STEM instructors might also have greater difficulty providing alternative forms of assessment (Bourke et al., 2000). Even in interview studies where STEM instructors express a desire to be inclusive, they appear to perceive barriers related to disciplinary teaching constraints such as "required course pace," which may limit flexibility (Embry & Mcguire, 2011). Instructor perceptions about the needs of disabled students appear to be at odds with their perceptions of rigor and success in STEM. This tension between academic rigor and equitable accommodations was also offered as an explanation for differential willingness to accommodate in two studies described above (Rao, 2004; Skinner, 2007).

4.1.4 | Instructional practices

Studies also outlined specific ways in which instructor practices for disabled students varied between STEM and non-STEM faculty, as presented in Table 3. A few studies focused on Universal Design principles of Instruction (McGinty, 2016) and Learning (Dallas et al., 2014). Dallas et al. (2014) found that science instructors are significantly less likely than instructors in other disciplines to employ one universal design principle: using multiple means of representation. McGinty (2016) adds that many faculty have little if any experience with universal design principles, indicating a lack of awareness for accessible teaching practices that address disability. Embry and Mcguire (2011) used Universal Design for Instruction to frame their findings related to graduate teaching assistant beliefs, although they note that none of their participants mentioned prior training in these principles.

To this point, McDowell (2020) found that when implementing accommodation strategies, STEM instructors might rely more heavily on "care practices" such as expressing emotional support rather than employing technical training or course design supports for disabled students. Barnard-Brak and Lan (2010) analyzed course syllabi and found that instructors in a college of education were more likely than those in engineering to have more accurate and longer disability statements on their syllabi, as determined by comparisons to boiler-plate statements provided by the Disability Services Center. Education faculty were also more likely to have made their own syllabi disability statements rather than use a boilerplate version (Barnard-Brak & Lan, 2010).

4.1.5 | Asset-based perspectives in faculty studies

The studies in Table 3 related to instructor willingness and ability to accommodate disabled students are not deficit-based to the extent that they target instructors for change, rather than the disabled students themselves. However, these studies also implicitly reinforce a medical model and system of disability accommodations that are the exception to "normal" teaching approaches. Some of these studies advocated for a universal design approach in which instructors integrate many common accommodations into their teaching routine and make them available to all students. Dallas et al. (2014) and McGinty (2016) even studied faculty knowledge of universal design principles. If successful, widespread instructor implementation of universal design would transform STEM education to be more accessible to disabled students and others, without expecting the students to change to fit the system.

4.2 | Student studies

Student studies exhibited much more variation in their outcomes and perspectives on disabled students. They were also more likely to combine all STEM disciplines into a single—sometimes unspecified—group. We organized the 18 student-focused studies into three categories: deficit-based ($n = 4$, Table 4), neutral ($n = 13$, Table 5), and asset-based ($n = 2$, Table 6). The deficit-based studies in Table 4 compared disabled students to an able-bodied norm and identified gaps or challenges to disabled student success in STEM primarily based on their personal characteristics. The neutral studies listed in Table 5 compared disabled students against each other, such as by the major area of study or use of accommodations; gaps were still identified in grades, confidence, or persistence. Asset-based papers (Table 6) presented at least one finding focused on positive outcomes for disabled students in STEM.

TABLE 4 Deficit-based student studies, $n = 3$.

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
Disability type and math course success (Castillo, 2020)	Logistic regression models of math course records of 846 students	Disability type was a significant predictor of math success for California community college students on the STEM track** but not for students on the statistics for liberal arts mathematics track.	STEM = STEM career path Non-STEM = Statistics for the Liberal Arts Mathematics (SLAM) career path
STEM major enrollment by GIs (e.g., veterans) with disabilities (Groah et al., 2017)	Descriptive statistics, central tendencies, and crosstabs of 1481 surveys and interviews	GIs with disabilities had lower participation in STEM programs than those without disabilities. Reasons they did not consider a STEM field include unappealing employment opportunities in STEM careers, lack of academic preparation, and lack of career counseling and academic advising.	STEM = unspecified "STEM" Non-STEM = all others
STEM major enrollment in 2-year, 4-year, and postsecondary vocation and technical programs (Lee, 2014)	Logistic regression of 897 National Longitudinal Transition Study-2 (NLTS2) responses	For 2-year college disabled students, female less likely*** and White and Asian more likely** to enroll in a STEM major. For 4-year college disabled students, female less likely***, lower income more likely**, and high math GPA more likely* to enroll in a STEM major. For postsecondary vocational and technical disabled students, female less likely*** and lower income more likely** to enroll in a STEM major.	STEM = mathematics, agricultural and natural sciences, physical sciences, biological sciences, engineering and engineering technologies, and computer and information sciences Non-STEM = all others

Note: * indicates $p \leq .05$, ** indicates $p \leq .01$, and *** indicates $p \leq .001$.

4.2.1 | Deficit-based student studies

Table 4 lists the three studies we coded as primarily deficit-based in their comparisons of disabled students against an able-bodied norm. These papers focus on academic success in math courses (Castillo, 2020) and choice of a STEM major (Groah et al., 2017; Lee, 2014) by disability status. Specifically, they find that disabled students are less likely to major in STEM overall (Groah et al., 2017; Lee, 2014) and that their disability status negatively impacts success in math courses (Castillo, 2020). We note that all three studies used quantitative data and methods. While perhaps well intentioned, these studies focus on the personal characteristics of the students including whether or not they have a disability; Lee (2014) also includes race, gender identity, and income. They fail to recognize accommodations and other systemic barriers that may account for disparities. Further, these studies treat disability as a single binary variable, essentializing the experience of all disabled students. Experiences of disabled students are diverse, even within a single diagnosis or categorization, and may add nuance to the discussion. For example, two students identifying as disabled may have drastically different symptoms, experience different attitudes toward them based on the visibility of their disability, and identify different support needs. When disability better informs study design and questions asked, studies start to take on more asset-based perspectives.

4.2.2 | Neutral student studies

Table 5 lists 13 studies we categorized as neutral, or not fully deficit- nor asset-based. These studies combined asset and deficit logic or attempted an asset framing without following through. All but one are quantitative studies. We further categorized these studies by focus, into three sections: engagement, identity, and self-efficacy ($n = 4$); accommodation use ($n = 3$); and academic outcome ($n = 6$).

TABLE 5 Neutral student studies, neither asset or deficit, $n = 13$.

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
Engagement, identity, self-efficacy			
Career decision self-efficacy (Dishauzi, 2016)	ANOVA and effect size of 57 questionnaire responses	Among students with the three highest frequency disability types in the sample (mental health, attention-deficit hyperactivity disorder [ADHD], and learning disabilities), STEM majors had lower career decision self-efficacy than non-STEM majors. Nine percent of the variance in career decision self-efficacy was explained by major and 3% by the interaction of disability type and major.	Unspecified
Disability identity and self-efficacy in students with autism spectrum disorder (Shattuck et al., 2014)	Linear regression of 120 National Longitudinal Transition Study-2 (NLTS2) responses	Among students with autism spectrum disorder, believing "one can handle most things that come their way" was significantly lower for STEM majors*.	STEM = computer science/ information technology, engineering, mathematics, and other hard sciences such as biology, physics, and chemistry Non-STEM = others, unspecified
Barriers for students with physical disabilities (Stumbo et al., 2011)	Interviews with 13 college graduates	STEM alumni were more likely to experience physical barriers, while non-STEM alumni felt socially isolated because of the physical barriers. STEM alumni more frequently said they felt like they were imposing because of their disability. Non-STEM majors more frequently discussed barriers with professor's unawareness and policy inflexibility. STEM majors more frequently felt no support from their department.	STEM = electrical engineering, chemistry, economics, and political science Non-STEM = art, finance, and law
Experiences of students with autism spectrum disorder (Hanna, 2016)	ANOVA of approx. 20 National Survey of Student Engagement (NSSE) responses	Non-STEM major students had more positive experiences than STEM** majors regarding self-advocacy, campus climate, course efficacy, and social efficacy in the few weeks prior to survey administration.	Unspecified
Accommodations use			
Decision to use accommodations (Monagle, 2015)	Chi-squared of 285 survey responses	Science, math, and engineering majors were less likely to request accommodations than students in liberal arts and humanities majors. Major may be also a significant predictor in regression.	STEM = math, science, and engineering Non-STEM = liberal arts, humanities
Use of extended time accommodation (Gelbar & Madaus, 2021)	Generalized linear mixed model (GLMM) of institutional data on 596 students in 1517 courses with 3726 exams	Taking a STEM course was a significant predictor*** of whether a participant used extended time at least once in a course.	(unspecified)
Course GPA by accommodations use (Parks, 2023)	Kruskal–Wallis test of 729,934 course final grades	Course grades were different between disabled students and students who identified as having a disability in a	STEM = construction and manufacturing, math, science and engineering

(Continues)

TABLE 5 (Continued)

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
		later semester for construction and manufacturing and math**. Among students with cumulative GPAs above 3.0, in their science and engineering and math courses, there were significant differences between students without disability status and students who used accommodation**. There were differences in average course GPA by accommodation status (i.e., had and used accommodations vs. had and did not use) for math courses at the 100 level***.	Non-STEM = academic foundations, art, business, healthcare, public service
Major choice, GPA, and persistence			
STEM major enrollment in 2-year and 4-year colleges (Lee, 2022)	Logistic regression of 198,512 National Longitudinal Transition Study-2 (NLTS2) responses	For both 2-year college and 4-year college disabled students, significant factors that made students more likely to major in STEM were difficulty conversing***, score on math calculation** problems (direct measure), and lower income**. Female**, African-American**, and Hispanic** disabled students were less likely than male/White to enroll in a STEM major. Additionally, for 2-year college disabled students, those with high social studies** and synonym–antonym** scores and lower passage comprehension** identity were more likely to major in STEM. Asian* students were less likely than White students to major in STEM. For 4-year college students, those with high passage comprehension** scores were more likely to major in STEM, while students with high social studies scores** and Asian** identity were less likely to major in STEM.	STEM = mathematics and statistics; agricultural and natural sciences; engineering and engineering technology; and computer and information sciences Non-STEM = all others
STEM major choice among students with autism spectrum disorder (Wei et al., 2017)	Weighted logistic regression, weighted means of 1100 NTLS2 responses of students with ASD	Among students with an ASD, higher odds of majoring in STEM were found among white students as compared to "minority" students**, older students as compared to younger students**, students with little or no trouble conversing***, and students who took advanced math classes*.	STEM = computer science, information technology, engineering, math and statistics, science, biology, earth science, geology, physics, chemistry, and environmental science Non-STEM = all others
Major choice and persistence to graduation of disabled students (Safer et al., 2020)	Chi-squared and logistic regression of 2578 disabled student records	Disabled students were underrepresented in STEM majors (6% of STEM students were disabled) than in social/behavioral sciences (11%–23% disabled). Disabled students in science/math (29% withdrawal rate) and computer/	STEM = computers and engineering, science and math Non-STEM = arts, media, communication, business, education, health and

TABLE 5 (Continued)

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
		engineering (28% withdrawal rate) were more likely to withdraw from the university than other majors*. In a logistic regression, disabled computer science/engineering** and disabled science/math** majors had lower odds of graduating than disabled arts/media/communication major reference group.	human services, liberal studies, and social sciences
Disability type and GPA (Chiu et al., 2019)	ANOVA of semester GPAs for 1935 registered disabled students	Disabled STEM students achieve lower GPAs than non-STEM disabled students, regardless of disability type***.	STEM = unspecified "STEM" Non-STEM = liberal arts and social sciences
GPA of disabled students (Mitchell, 2007)	ANOVA of 785 student records	Among registered students with disabilities, engineering majors have lower GPAs than other disciplines, both cumulatively*** and after arriving at the institution**.	STEM = engineering Non-STEM = arts, business admin, education, health/ human services, liberal arts, undeclared
Postsecondary enrollment and persistence rates of students with ASD (Wei et al., 2014)	Institutional records and Chi-squared and logistic regression of 210 National Longitudinal Transition Study-2 (NLTS2) responses	STEM majors with ASD had fewer difficulties in conversations* compared to non-STEM majors with ASD and were more likely to persist in college***. Male students with ASD had higher odds than women with ASD of persisting in college**, particularly in STEM majors***. Similarly, Black Hispanic. or other minority students with ASD were more likely than White students with ASD to persist in college * and STEM*. ASD students with more trouble conversing were more likely to persist, but this was significant only for non-STEM majors*.	STEM = computer science, programming, information technologies, engineering, mathematics and statistics, science, biology, earth science, geology, physics, chemistry, and environmental science Non-STEM = all others

Note: * indicates $p \leq .05$, ** indicates $p \leq .01$, and *** indicates $p \leq .001$.

The first category—engagement, identity, and self-efficacy—includes four studies, one of which is qualitative (Stumbo et al., 2011). Disabled STEM students reported a less positive environment (Hanna, 2016), including more physical barriers and less department support (Stumbo et al., 2011), which may explain why disabled STEM students reported a lower ability to "handle things that come their way" (Shattuck et al., 2014). Further, disabled students reported lack of flexibility from their STEM instructors, feeling like they were imposing because of their disability (Stumbo et al., 2011). Disabled STEM students also had less career self-efficacy than their non-STEM counterparts (Dishauzi, 2016). Taken together, these studies point to STEM as a less supportive educational environment for disabled students than other disciplines.

Three studies examined accommodation use from the perspective of disabled students, relying on quantitative data from academic records and a survey. STEM students with disabilities were less likely than non-STEM counterparts to request accommodations (Monagle, 2015); however, taking a STEM course was a significant predictor for using an extended testing time accommodation (Gelbar & Madaus, 2021). Parks (2023) took an explicitly critical and intersectional approach in providing important data to demonstrate persistent gaps in disability status by race. Her comparisons of disabled students using and not using accommodations lead to the conclusion that accommodations matter more to final grades in STEM courses than other disciplines (Parks, 2023). These findings may be collectively explained by less openness among STEM instructors to discuss accommodations or change instructional practices to make them more accessible,

TABLE 6 Asset-based student studies, $n = 2$.

Outcome or dependent variable	Sample and analyses	Reported differences	STEM and comparison disciplines
Science identity (Gormally & Inghram, 2021)	Forty-seven interviews with significance testing of STEM versus non-STEM majors mentioning 17 coded beliefs about science	A greater number of students who identified as either women, deaf, or non-science majors tended to express interest in altruistic, communal career opportunities while not perceiving these to be afforded in science.	STEM = biology Non-STEM = non-science majors
Disclosure of invisible disability to an instructor (Carter, 2021)	Twelve interviews	STEM faculty were mentioned most often by students for having negative reactions to disclosure. But STEM majors had the most positive outcomes because these interactions forced them to develop advocacy skills. A difference in perception of the need for accommodations may exist between STEM and non-STEM courses.	STEM = mechanical engineering, biology, chemistry, neuroscience, and molecular biology and immunology Non-STEM = education, philosophy, nursing, public health, social work, epidemiology, and general studies

resulting in both a greater need for accommodations in STEM courses and a tendency of disabled students to avoid these difficult conversations with their instructors.

The third category, namely major choice, grade point average (GPA), and persistence, includes six quantitative studies relying on academic records and panel data from NLTS2. The two studies comparing GPAs both found that disabled students in STEM had lower GPAs than their non-STEM disabled counterparts (Chiu et al., 2019; Mitchell, 2007). Disabled students are also less likely to major in STEM than their non-disabled peers (Safer et al., 2020). Although these studies primarily identify gaps between disabled and non-disabled students, the differences are by major, which could be attributed to STEM environments.

The studies focused on major choice and persistence have more conflicting findings due to focus on different disabled student populations. Safer et al. (2020) concluded that disabled students majoring in STEM are less likely to persist to graduation, while Wei et al. (2014) found that STEM students with autism spectrum disorder (ASD) were more likely to persist than their non-STEM counterparts. The NTLS-2 study includes questions about difficulty conversing, which Wei et al. (2014, 2017) used to report that among students with an ASD, STEM majors had less trouble conversing than non-STEM majors. Also using the NTLS-2 data, Lee (2022) came to a nearly opposite conclusion, specifically that disabled students struggling to converse are more likely to go into STEM majors. These conflicting findings can be traced back to Wei et al.'s studies of students with ASD specifically (as compared to the others, who used larger samples of more disability types from NTLS-2), which emphasizes the need for future work to examine differences between or greater focus on specific disability types.

4.2.3 | Asset-based student studies

We coded only two studies as asset-based (Table 6), and both were interview studies. Gormally and Inghram (2021) found more altruistic, communal career interest among non-STEM majors, women, and deaf participants as compared to majority counterparts. Carter (2021) highlights not only the negative experiences disabled students with invisible disabilities have disclosing their access needs to STEM instructors in particular, but also finds these experiences force students to develop important advocacy skills. He does not go as far as noting that the system of educational accommodations should not be set up to require self-advocacy skills of students (Pfeifer et al., 2021). Both of these studies support the narrative of STEM as a more challenging and socially distanced set of majors, at least in part due to instructor behaviors.

5 | DISCUSSION

We reviewed 37 research studies from 1979 to 2023 that report differences between engineering, STEM, and other disciplines that are relevant to the experiences of disabled undergraduate STEM students. Nearly equal numbers of studies focus on students ($n = 17$) or instructors ($n = 20$).

In response to our first research question—What are the published differences between STEM and non-STEM that impact the success of disabled students?—we find moderate evidence that STEM instructors are less willing and/or less knowledgeable about how to support disabled students through accommodations or course design. Engineering instructors focus their accommodations on exams (e.g., extended time), while non-STEM instructors tend to favor formative accommodations (e.g., notetakers, proofreaders) and flexible learning objectives. However, we note a limitation to the survey scales used in these studies, many of which ask about a range of specific accommodations. Many of these accommodations support courses with heavy writing components, which are not characteristics of many undergraduate STEM courses. It is unclear whether STEM instructors are less willing to implement these formative accommodations, or whether they simply do not see the relevance of such accommodations to courses without writing assignments.

In considering how a review focused on engineering rather than STEM might differ in its conclusions, we note that nearly all of the differences are in instructor studies. In Tables 4–6, only one student study (Mitchell, 2007) used engineering as its only STEM discipline. The other four relying on engineering were focused on instructors (Table 3; Barnard-Brak & Lan, 2010; Brockelman, 2005; McGinty, 2016; Rao & Gartin, 2003). The nine studies that include science or math but not engineering are all faculty studies (Bourke et al., 2000; Dallas et al., 2014; Embry & McGuire, 2011; Lombardi & Murray, 2011; McDowell, 2020; Murray et al., 2008; Nelson et al., 1990; Skinner, 2007; Williamson, 2000). Even without these nine, we still located plenty of studies supporting claims that engineering faculty have more negative attitudes toward disabled students (Fonosch, 1979; Lewis, 1998; Schoen et al., 1987), are less willing to accommodate disabled students (Lewis, 1998; Rao & Gartin, 2003), favor extended time accommodations as more effective (Brockelman, 2005), and rate specific accommodations as less equitable (Alghazo, 2008), as compared with instructors in non-STEM disciplines.

Student studies focus on a wide array of outcomes and replicate prior results by student major, such as STEM majors have lower GPAs and are retained and graduate at lower rates than students in other majors. These findings add little to our knowledge base beyond confirming that known challenges in STEM disciplines also apply to disabled students. Future work should continue to look for more nuanced comparisons such as those by specific teaching contexts or by disability status (such as disability type or accessing accommodations), or should avoid comparisons altogether. We should move beyond GPA, persistence, and graduation rates as outcomes to measure disabled student success.

A major limitation to this comparative analysis of STEM versus non-STEM disciplines is the lack of uniformity in how the studies classify disciplines. A number of studies were conducted at a single institution and relied on that institution's organization by colleges and schools. In particular, basing analysis on combined colleges of arts and sciences does little to address any question of disciplinary differences. We call for future studies to use a standardized classification system such as the Classification of Instructional Programs (CIP) published by the National Center for Education Statistics (NCES, 2002).

Readers may be surprised that no conference papers were included in the qualifying set of studies. Yet, the larger scoping review database of 409 studies included 58 conference papers, primarily from American Society for Engineering Education (ASEE), Frontiers in Education (FIE), and Physics Education Research conferences (Borrego et al., 2025). Since many education conferences do not copyright their papers to preclude developing the work into a journal article, the conference papers considered for inclusion were primarily from discipline-based education research conferences. It is reasonable to imagine that when researchers make disciplinary comparisons across the broad categories of STEM and non-STEM disciplines, they would choose a venue other than a specialized disciplinary conference. In other words, the comparisons we synthesized may be considered by many as inherently more appropriate for journal or dissertation publication.

Finally, we note sources of bias in the primary studies themselves. In medical systematic reviews, bias is assessed based on (lack of) research designs such as double-blind and randomized treatment groups. Education research typically does not have that level of control. Some of the studies reviewed here relied on recruiting students who registered with disability services offices, who are only about 35% of those identifying as disabled (Adam & Warner-Griffin, 2022). Similarly, data were largely collected from students and instructors who are interested enough in the topic of disability to participate in a study. Finally, publication bias is an important concern. In the current review, this may be mitigated slightly by most authors' interest in a large number of variables (e.g., faculty rank, race and gender identities), which makes it easier to publish nonsignificant differences for discipline. There remains the concern that some published studies chose to focus on significant differences without mentioning disciplinary comparisons that they viewed as less interesting or less publishable.

In response to our second research question—To what extent are studies employing an asset-based perspective?—we find that many studies took an implicit deficit view of students with disabilities by focusing explanations on individual characteristics. A small number of studies emphasized structural characteristics of STEM and higher education that act as barriers by socially constructing disability. Studies of instructors and comparisons of disabled students by major are not necessarily asset-based but do place the onus of change on the STEM educational system and not disabled students themselves.

We also note that asset-based studies tend to direct the conversation away from disparities between STEM and non-STEM contexts. Asset-based studies delved into newer and more systemic ideas about the differences between STEM and non-STEM environments for disabled students. These asset-focused inquiries aimed to highlight strengths and resources. Conversely, studies we labeled as deficit-based were typically framed around the search for discrepancies, emphasizing and perpetuating achievement gaps between STEM and other majors. We discovered that many studies implicitly adopted a deficit view by attributing explanations to individual characteristics. We acknowledge that sometimes an important first step is to gather data that there are indeed gaps warranting further efforts to support a particular group, but now that work has been done. Only a few studies explicitly addressed structural barriers within STEM and higher education, which socially construct disability by creating unnecessary barriers. While studies examining instructors and comparing disabled students by major may not inherently adopt an asset-based approach, they do advocate for systemic changes within the STEM educational system rather than placing the burden solely on disabled students themselves.

5.1 | Research agenda

These findings lead us to recommendations for future work. First, critical and asset-based perspectives are needed in future study designs that center disability to uncover systemic barriers and identify assets among disabled students and instructors. Prior studies have identified the many barriers for disabled undergraduates, within and beyond STEM settings, including but not limited to onerous accommodation bureaucracy, discouraging messages from instructors, and ableist expectations of students and scientists (Bettencourt et al., 2018; Friedensen et al., 2021; Jeannis et al., 2018; Lee, 2011; Wrage, 2017). However, much of this work is not guided by theoretical perspectives that go beyond asserting a social model of disability. If our systems are not fully critiqued, then an implicit deficit view of disabled students and their inability to navigate an unquestioned system is allowed to persist.

What is needed is far more work that identifies strengths of different students with different disabilities, such as increased self-advocacy skills (Kreider et al., 2018; Pfeifer et al., 2021), navigational capital (Listman & Dingus-Eason, 2018), and resilience and agility (Polmear et al., 2021). It is important to continue to acknowledge that our higher education system was not designed to support disabled students and the retrofit system of accommodations is itself oppressive in labeling, separating and creating additional barriers for disabled students. Disabled students should not have to develop self-efficacy and navigational skills; nonetheless, these are important assets in the current environment. Similarly, more studies are needed that ask what is most effective at supporting disabled student success, and what strategies are most effective at removing barriers.

To critically examine the systemic elements influencing the experiences of disabled students and instructors, it is essential to interrogate underlying assumptions and norms within educational settings, particularly assumptions about STEM. If we continue to analyze data based on the assumptions that STEM and non-STEM environments are distinct, then what elements that differ between the two should be critiqued? Many engineers will point to the lab environment and project work as distinguishing factors. In an educational context, are physically manipulating lab equipment or standing for long periods to monitor testing equipment necessary learning outcomes? Why do engineers have to think quickly and work in teams? Why do so many STEM instructors insist that we can only assess knowledge with timed exams? Additionally, the high courseloads prevalent in many degree programs may contribute to stress and burnout, disproportionately affecting disabled students who may require more time or support to manage their workload effectively. These investigations within and across disciplinary lines have the capacity to actively improve disabled experiences in academia.

Regarding faculty studies, more work is needed to examine instructor actions beyond their intentions and attitudes toward disabled students. There is already plenty of evidence that STEM faculty tend to have less positive attitudes toward disabled students and less willingness to accommodate them. While future studies may update and replicate these findings, we suggest using a standardized disciplinary categorization such as CIP codes (NCES, 2002), recruiting faculty participants from multiple institutions, and exploring more deeply the relationships between intersectional identities, faculty rank, and disability experience level. In most of the studies we reviewed, these characteristics were collected, but sample sizes were not large enough to consider interactions. Additionally, more qualitative studies are needed of how faculty learn, evolve, and think about disability, such as in dissertations by Flood (2017), Green (2018), and Love (2017). Participation bias in such studies by instructors committed to accessibility, particularly in-depth interviews or observations, may continue to be a limitation.

For student studies, we note that all of the deficit studies in Table 4 and most of the neutral studies in Table 5 are quantitative. Many make use of large datasets (national, state, multi-institution, and institution), and most compare disabled students to students without disabilities. It is nearly impossible to take a critical asset-based approach to disability research using direct comparisons between a monolithic disabled group and non-disabled group. Use of a critical theoretical framework to guide future studies makes it evident that comparing disabled students to a dominant norm would always identify deficits or gaps. We intentionally avoided opening this article with outdated and overused statistics quantifying the gaps in disabled student graduation rates. Some of the studies we reviewed focus on a specific disability type or analyze only data from disabled students, which is a step in the right direction. We acknowledge that researchers are limited by the data to which they have access and that others have called for expanded disability-related questions on national surveys (e.g., de Leon & Freedman, 2015). There is an inherent tension between the goals of generalizability and reducing sample size by intersecting characteristics such as disability type and major. Yet critical quantitative approaches (Wells & Stage, 2015) to such analyses could draw attention to the limitations of the data without essentializing the experiences of disabled students. There is also great promise in balancing out this research base with more qualitative interviews, document analysis, and observational studies.

Finally, we note that studies of disabled students are incomplete without the perspectives of disabled students who do not receive formal accommodations. Since only one-third of disabled undergraduate students disclose to their institution (Adam & Warner-Griffin, 2022), student participants should not be recruited entirely from among those registered with a disability resource center (unless the research question focuses on formal accommodation experiences). A commitment to disability identity as changing over time would demand more flexibility and student agency in sampling. Simply obtaining medical documentation required by most institutions for disability accommodations is a privilege and expense not available to all students in need of these supports. Further, it is just as important to understand why students are choosing not to disclose or have stopped requesting accommodations from their instructors each semester.

5.2 | Limitations

A number of limitations inherent to systematic reviews should be noted. First, although we reached saturation among the literature cited in our qualifying studies, it is possible we did not locate every primary study meeting our inclusion criteria. Recent work may have been published or added to our search databases since we conducted our searches. Among our seven databases, we did not include Compendex and Inspec, two major engineering databases that may have had more complete coverage of ASEE conferences including FIE. However, our larger scoping database included papers from FIE conferences in 2006–2011 and ASEE annual conferences from 2011 forward. That no conference papers were included in the final set of qualifying studies may be more a reflection that authors chose to publish their comparative studies in other venues. Second, there is inconsistency in how study authors classified STEM and non-STEM disciplines, including a few studies that do not list the specific disciplines at all. Multiple study authors relied on institutions' categorizations of disciplines by college, and some of these included colleges of combined arts and sciences. Although engineering, when present at an institution, is often in its own college, the majority of studies combined STEM disciplines for their analyses. We have tried to be as transparent as possible in the tables listing each study about the disciplines being compared. Relatedly, most studies were conducted at a single higher education institution and therefore have limited generalizability. Third, we relied on primary study authors' assertions about which differences were worth emphasizing as findings. For example, many but not all authors of quantitative studies relied on statistical significance, and the total number of comparisons influenced what authors chose to present or emphasize as their main findings. Fourth, we did not include studies or results of included studies where STEM/non-STEM disciplinary differences were investigated but not found. Considering that citation searching was a key strategy for identifying qualifying studies and that nonsignificant results are less likely to be published or cited, we did not believe we could effectively identify all such studies. This gives an incomplete picture of potentially conflicting results. We direct readers, if interested in a specific construct, to use the literature reviews embedded in the primary studies to identify additional studies that did not find disciplinary differences. For example, some of the dissertations focusing on instructor attitudes include thorough literature reviews of prior studies that did and did not find disciplinary differences (e.g., Alghazo, 2008).

6 | CONCLUSION

These findings compel us to question the value of accentuating differences between engineering, STEM, and other disciplinary experiences for undergraduate disabled students. The conclusions drawn from existing research lack depth and robust empirical support. It becomes imperative then to delve into the implicit biases and systemic barriers ingrained within STEM disciplines, often incorrectly perceived as scientific, objective, and inherently challenging. What then is the motivation to directly compare STEM and non-STEM disciplines? For those who strongly identify with a STEM discipline and publish in discipline-based education research venues such as this journal, the choice of discipline is implicit and based on concern for the future of the field. By reframing the discourse to examine how ableism operates within STEM disciplines, future research can shed light on the dynamics at play and pave the way for more inclusive educational practices. As Slaton (2013) notes, disability is frequently positioned as an afterthought in discussions of inequities, following mentions of race and gender, highlighting the need to foreground disability and ableism in analyses of systemic biases within academic settings.

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APPENDIX

SEARCH STRINGS

This appendix presents complete search strings used for each database. All searches were limited to 2005 and forward.

Database: Academic Search Complete

Search terms:

TI ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR AB ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR SU ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR KW ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))

AND

TI ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR AB ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR SU ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR KW ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM))

AND

TI ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR AB ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR SU ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR KW ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*))

AND

TI ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR AB ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR SU ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR KW ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university))

Database: APA PsycINFO

Search terms:

TI ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR AB ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR SU ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR KW ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))

AND

TI ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR AB ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR SU ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR KW ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM))

AND

TI ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR AB ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR SU ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR KW ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*))

AND

TI ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR AB ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR SU ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR KW ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university))

Database: Education Source

Search terms:

TI ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR AB ((abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR SU ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR KW ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))

AND

TI ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR AB ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR SU ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR KW ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM))

AND

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AND

TI ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR AB ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR SU ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR KW ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university))

Database: ERIC

Search terms:

TI ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR AB ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR KW ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR SU ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))

AND

TI ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR AB ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR KW ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR SU ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM))

AND

TI ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR AB ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR KW ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR SU ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*) OR DE (Laboratories))

AND

TI ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR AB ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR KW ((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR SU ((college OR "higher education" OR "post secondary" OR post-secondary OR "post-secondary" OR undergrad* OR university))

Database: Proquest Dissertations & Theses Global

Search terms:

(ti((abledness OR ableness OR ableism OR accessibility OR accommodation OR ("assistive technologies" OR "assistive technology") OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR ("universal design") OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) NEAR/2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR ab((abledness OR ableness OR ableism OR accessibility OR accommodation OR ("assistive technologies" OR "assistive technology") OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR ("universal design") OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) NEAR/2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))) AND (ti(((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM) NEAR/4 (class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*))) OR ab(((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM) NEAR/4 (class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)))) AND (ti((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university)) OR ab((college OR "higher education" OR "post secondary" OR postsecondary OR "post-secondary" OR undergrad* OR university))) AND pd.(20231019-20241018)

Database: SocINDEX

Search terms:

TI ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR AB ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR SU ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))) OR KW ((abledness OR ableness OR ableism OR accessibility OR accommodation OR "assistive technolog*" OR blind* OR "Crip Theor*" OR deaf* OR disab* OR "Dis/ability" OR DisCrit OR PwD OR SwD OR "universal design*" OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) N2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*))))

AND

TI ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR AB ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR SU ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM)) OR KW ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM))

AND

TI ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR AB ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR SU ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*)) OR KW ((class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*))

AND

TI ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR AB ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR SU ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)) OR KW ((college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university))

Database: Web of Science

Search terms:

TS = (abledness OR ableness OR ableism OR accessibility OR accommodation OR “assistive technolog*” OR blind* OR “Crip Theor*” OR deaf* OR disab* OR “Dis/ability” OR DisCrit OR PwD OR SwD OR “universal design*” OR ((disorder* OR deficit* OR impair* OR limit* OR loss*) NEAR/2 (audit* OR hear* OR mobil* OR physica* OR sight* OR vision OR visual*)))

AND

TS = ((astron* OR biolog* OR chemistry OR engineer* OR geolog* OR geoscience OR math* OR physics OR science* OR statistics OR STEM) NEAR/4 (class* OR course* OR discipline* OR education OR field* OR instruction* OR learn* OR teach* OR student*))

AND

TS = (college OR “higher education” OR “post secondary” OR postsecondary OR “post-secondary” OR undergrad* OR university)