

Undergraduate STEM Instructors' Teacher Identities and Discourses on Student Gender Expression and Equity

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Abstract

Background Despite long-standing initiatives to improve gender equity across STEM fields, women's representation in undergraduate engineering programs remains low. STEM faculty, as influential gatekeepers, can promote gender inclusivity in these fields. Yet, little is known about how faculty construct their responsibilities to advance gender equity.

Purpose/Hypothesis We investigated how STEM faculty teaching first-year engineering courses constructed teacher identities and responsibilities. Our research questions included: What discourses do faculty use to construct the meaning of student gender expression in their classroom? How do faculty discursively position themselves in relation to gender equity? What teacher identities and responsibilities do they construct through these discourses?

Design/Method Utilizing a feminist, poststructural epistemology and discursive methodology, we analyzed 18 interviews with instructors in three undergraduate engineering programs. After coding data for ways instructors talked about gender in their work with students, we analyzed how faculty constructed their teacher identities in relation to each discourse and how these positions affected their promotion of gender equity.

Results Faculty used three dominant discourses to construct student gender expression and teacher identities: gender blindness, gender acknowledgment, and gender intervention. Faculty most frequently utilized discourses acknowledging gender inequity, which often limited their responsibilities to promote equity and highlights the pernicious nature of systemic gender bias.

Conclusions Findings suggest that institutions could expand discourse and better align faculty awareness of gender inequity with meaningful, pedagogical change strategies.

Keywords gender; faculty; STEM; qualitative research; discourse analysis

Introduction

Policymakers have suggested that the underrepresentation of women and minorities in U.S. science, technology, engineering, and mathematics (STEM) fields may limit growth, innovation, and responsiveness to the needs of a dynamic and diverse society (e.g., Beede et al.,

2010; Corbett & Hill, 2015). Yet, despite numerous calls by national leaders and advisory groups to increase the representation of these groups in STEM education and careers (e.g., Committee on Equal Opportunities in Science and Engineering, 2015; National Academies, 2010, 2011; White House Council on Women and Girls, 2012) and long-standing initiatives to improve gender equity in STEM fields (Rossiter, 2012), women's underrepresentation persists in postsecondary STEM education and remains strikingly low: 19.2% in 2012 in undergraduate engineering programs (the educational context of this study; National Science Foundation, 2015). Scholars have suggested that these gender disparities are largely related to sociocultural factors, and that implicit biases held by faculty and peers can serve as obstacles to women's persistence in these pathways (Corbett & Hill, 2015; Moss-Racusin, Dovidio, Brescoll, Graham, & Handelsman, 2012). Research has also found that undergraduate STEM faculty can have an important influence in promoting gender equity in these fields (Adelman, 1998; Gayles & Ampaw, 2014; Marra, Rodgers, Shen, & Bogue, 2012).

Given the persistent gender gap and both the opportunities and obstacles for STEM faculty members to act as change agents to promote the success of diverse students, we aimed to learn more about how STEM faculty construct their teacher identities and responsibilities amid calls for gender inclusivity in the STEM fields. While studies have illuminated how pedagogical practices influence gender dynamics in STEM classrooms (e.g., Blickenstaff, 2005; Seymour & Hewitt, 1997), few studies have investigated how STEM faculty conceptualize their roles, responsibilities, and teacher identities in relation to the movement for inclusivity in engineering. This article begins to address this gap. The purpose of this discourse analysis study is to analyze how STEM faculty teaching gateway engineering courses in three undergraduate engineering programs talk about students' gender expression and how these instructors position their teacher identities and responsibilities to promote gender equity in STEM through this discourse (Cresswell, 2007). In this study, we took a poststructuralist, discursive, and dynamic approach to identity. This approach views identity not as a static, internal state; rather identities are dynamically constructed through linguistic practice and narratives circulating in public discourse in the multiple sociocultural contexts participants inhabit (Allie et al., 2009; Davies, 1989; Gee, 2000; Skerrett & Sevian, 2010). To paraphrase Gee (2000), this study specifically explored how STEM faculty use discourse to position themselves as "certain kinds" of teachers in relation to efforts for gender equity (p. 110). This study was guided by three research questions:

What discourses do faculty use to construct the meaning of student gender expression in their classroom?

How do faculty discursively position themselves in relation to gender equity?

What teacher identities and responsibilities do they construct through these discourses?

Using a discursive approach to analyzing faculty interview data, we find that instructors take up three primary positions in relation to actions promoting gender equity: gender blindness, gender acknowledgment, and gender intervention. We suggest that faculty members' most prevalent discursive positions – gender blindness and gender acknowledgment – located the duty to promote gender equity as outside of their teacher identities and responsibilities. The gender intervention position oriented faculty as warranted to act to disrupt gender inequity, although actions instructors describe may not necessarily advance their aims. We conclude by discussing how faculty members' constructions of their teacher identities may connect to the complexity of addressing persistent gender gaps in STEM, and explore

implications for promoting inclusivity, gender equity, transformative pedagogies, and broader social change along engineering educational pathways.

Background

A wealth of literature has broadly explored causes of women's disproportional representation in STEM fields and suggested that sociocultural factors are largely responsible for persistent disparities (Hyde & Linn, 2006; Blickenstaff, 2005). Decreases in academic performance and persistence of women in these fields have been attributed to individual factors tied to socio-cultural dynamics, including differential preparation (Ackerman, Kanfer, & Calderwood, 2013) and psychosocial constructs, including social identity and stereotype threat (Corbett & Hill, 2015; Logel et al., 2009), professional role confidence (Cech, Raineau, Silbey, & Seron, 2011), self-efficacy beliefs (Raelin et al., 2014; Wang, 2013; Williams & George-Jackson, 2014), and perceptions of barriers (Scott & Martin, 2014).

Research has documented that the first year of college is a key gateway for student persistence in STEM fields (Ferrare & Lee, 2014; Griffith, 2010; Seymour & Hewitt, 1997). One recent study found that 39.3% of intended U.S. undergraduate STEM majors switched to a non-STEM field by the end of their first year in college (Ferrare & Lee, 2014). Noteworthy for the design of this study, research has suggested a prominent gendered trend in this STEM attrition (Ferrare & Lee, 2014; Griffith, 2010; Seymour & Hewitt, 1997). In Ferrare and Lee's (2014) analysis, 44.5% of women switched out of STEM majors by the end of their first year compared with 36.8% of men. When measures of social and academic integration were included in statistical models, the odds of women switching out of STEM majors after the first year were 1.51 times higher than for men.

Institutional and cultural factors, such as chilly departmental culture, teacher-centered pedagogical practices, overassertive classroom behavior of male classmates, institutionalized sexism, and limited access to mentoring relationships have been found to shape women's experiences and attrition in STEM (Blickenstaff, 2005; Corbett & Hill, 2015; Hartman & Hartman, 2008; Kanny, Sax, & Riggers-Piehl, 2014; Ohland et al., 2011). Scholarship has suggested that gendered expectations and hegemonic masculinity in these educational cultures negatively affect women's performance and persistence in these disciplines (Henwood, 1998; Hutchinson-Green, Follman, & Bodner, 2008; Kanny et al., 2014; Murphy, Steele, & Gross, 2007).

Teaching Diverse Students

Research has indicated that STEM faculty have an important influence on the gender gap in STEM. Undergraduate course instructors are prominent figures in the STEM cultures that undergraduate students encounter, since they serve as mentors, role models, and gatekeepers to advancement in the STEM training programs, through which women must persist in order to enter professional practice (Adelman, 1998; Amelink & Creamer, 2010; Gayles & Ampaw, 2014). Scholarship finds that STEM faculty hold widespread, subtle gender biases that can influence students' progression through these gateways (e.g., in hiring and mentoring decision making; Corbett & Hill, 2015; Moss-Racusin et al., 2012). Faculty members' pedagogical practices also influence gender dynamics in the classroom (Blickenstaff, 2005; Corbett & Hill, 2015), and poor teaching and advising have been documented as strong sources of student dissatisfaction with and disengagement from the STEM fields (Marra et al., 2012; Seymour & Hewitt, 1997; Watkins & Mazur, 2013). The influence of faculty

and coursework may be especially powerful in shaping students' first-year college experiences (Busch-Vischniac & Jarosz, 2004). First-year students are more likely than their upper-class counterparts to feel dissatisfied with teaching and to perceive gender issues as problematic in their STEM courses, difficulties that can influence women and minority students' decisions to exit from STEM majors (Hartman & Hartman, 2008; Seymour & Hewitt, 1997).

Despite the important role teaching may play in students' departure from STEM pathways, STEM faculty are often provided little incentive or support to develop efficacious approaches for working with underrepresented students (Baber, 2015). Scholars utilizing a range of approaches to studying identity have contended that in STEM departmental cultures, faculty members' professional identities often center on their role as researchers, while teacher identities are underdeveloped, undervalued, and delegitimized (Aydeniz & Hodge, 2011; Besterfield-Sacre, Cox, Borrego, Beddoes, & Zhu, 2014; Brownwell & Tanner, 2012; Kreber, 2010). STEM faculty members often construct teacher identities and approaches based on their own educational experiences and familiar pedagogical discourses, utilizing teacher-centered, didactic, rationalistic approaches for teaching undergraduates that often fail to address the pedagogical needs of diverse learners (Aydeniz & Hodge, 2011; Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006). Scholars have suggested that teacher identities and beliefs about good teaching inform pedagogical intentions (Hockings, Cooke, Yamashita, McGinty, & Bowl, 2009; Kember, 1997; Kember & Kwan, 2000; Norton, Richardson, Hartley Newstead, & Mayes, 2005; Trigwell & Prosser, 1996). In these conditions and contexts, faculty members often draw on tradition-bound teaching identities; lack access to student-centered, critical, and constructivist teaching dispositions; and remain unaware of the advantages of these pedagogies for promoting learning among diverse students (Aydeniz & Hodge, 2011; Chen, Lattuca, & Hamilton, 2008; Kreber, 2010; Taylor, 2011; Taylor, Gilmer, & Tobin, 2002). When departmental discourse is less focused on promoting high-quality, critical teaching approaches, STEM faculty may be ill-equipped to construct teaching identities focused on meeting the needs of all students. As a consequence, STEM faculty contribute to the reproduction of gendered patterns of student success in STEM departments (Bianchini, Cavazos, & Helms, 2000; Calabrese Barton & Osborne, 2001; Claris & Riley, 2012; Mayberry, 1998). These findings give rise to larger questions about how faculty members' teacher identity constructions link to the persistent gender gap in STEM fields, and how faculty members can be better positioned to improve gender equity by expanding their teaching identities and practices.

Epistemological and Methodological Framework

This study responds to calls to expand understanding of engineering education through research drawing on broader epistemologies and qualitative methodologies (Baillie & Douglas, 2014; Beddoes & Borrego, 2011; Borrego, Douglas, & Amelink, 2009; Case & Light, 2011; Koro-Ljungberg & Douglas, 2008). We take up a feminist, poststructural epistemological perspective and discursive methodology to describe and critique teacher identity positions and explore how they relate to the complex processes that influence gender inequity in engineering programs. Both our research questions and methodology take a feminist perspective: as Lather (1991) notes, "very simply, to do feminist research is to put the social construction of gender at the center of one's inquiry" (p. 71). Doing so through a poststructural, discursive lens means that we focus on the ways individuals understand the world and construct identities by taking up common-sense ideas and assumptions from the language they encounter

across various social contexts (Case & Light, 2011; Edley, 2001). Poststructural discourse theorists posit that available discourses are embedded in and influenced by context (Willig, 2001). Moreover, these theorists believe that individual discourses serve to normalize some actions and identities while making other ways of knowing and understanding invisible (Allie et al., 2009; Davies, 1989). According to poststructural theories, individuals take up and use language they encounter in their social worlds to craft a particular depiction of events, constructing a unique version of reality and the self to achieve particular (often implicit) goals (Lynch & Nowosenetz, 2009).

In contrast to more traditional psychological and sociological views of identity, which characterize identity as a fixed set of characteristics, cognitive schemas, or roles that develop and become stable in adulthood and are shaped by broader cultural and institutional demands (e.g., Erikson, 1968; Lortie, 1975), a poststructural approach views identity as constantly in motion (Edley, 2001; Hall, 1996; Skelton, 2012). For more context on various schools of identity theory and research, see Skelton (2012) and Avraamidou (2016). Hall (1996) defined identities as “points of temporary attachment to the subject positions which discursive practices construct for us” (p. 6). We took up this poststructural approach in exploring teacher identities, drawing on Skelton’s (2012) perspective: “Teacher identities from this vantage point are constituted and reconstituted through the discursive practices, subject positions and narratives people have access to and use in making sense of their working lives and relationships (Weedon, 1987)” (p. 27). As Jonsson (2014) explains, in this sociocultural view of identity, “the constitutive character of language [. . .] plays a crucial role in the construction of particular identities” (p. 279) and discourse frames which actions and ways of being make sense for speakers (Beddoes, Schimpf, & Pawley, 2013; Gee, 2000; Willig, 2001). By looking closely at the ways faculty position themselves in relation to available categories and storylines in STEM communities, we aimed to document how instructors discursively construct teacher identities and normalize particular pedagogical behaviors (Beauchamp & Thomas, 2009; Gee, 2000; Hall, 1996; McLean, 2012).

While discourses provide a toolbox for constructing identities, poststructural scholars suggest that shifting discourses also open opportunities for broader social change by making new ways of understanding social relationships and new identities, rights, and duties available and socially legitimate (Acker, 2006; Edley, 2001; Lynch & Nowosenetz, 2009). For example, the institutionalization of the concept of sexual harassment shifted popular understandings of students engaging in unwanted, provocative sexual gestures in schools from the seemingly “natural” behavior of “boys being boys,” to problematizing these positions by means of sexual harasser identities (Davies, 1989). Access to the discourse of sexual harassment created new ways for teachers to make sense of student behavior and discursively legitimated activist teacher identities and interventions. A poststructural feminist approach, then, opens up the opportunity for shifts in everyday speech and practice to disrupt the taken-for-granted knowledge and structures that legitimate social injustice. Scholars suggest that engaging teachers in critical reflection about their identities and constructing activist teaching identities, along with enhancing pedagogical skills to meet the needs of diverse learners, are central to promoting inclusivity and resisting systemic inequity in schools (e.g., Howard, 2006; Riley, Pawley, Tucker, & Catalano, 2009; Turner, 2015).

Poststructuralist theory, and the discursive turn that is central in its formation, also informs the way we, as researchers, take up feminist theory and conceptualize gender in institutional contexts of STEM (St. Pierre, 2000; Beddoes, & Borrego, 2011). Feminist queer theorist Judith Butler (1990) defined gender as performative, rather than a fixed characteristic:

femininities and masculinities are constructed through a “grid of cultural intelligibility through which bodies, genders, and desires are naturalized” (p. 151). Poststructural feminists have suggested that while gender may appear “natural,” it is actually produced in the negotiating of discursive scripts already socially and culturally formed with specific effects (Butler, 1990; Davies, 1989; Renold & Allan, 2006). Indeed, as Francis and Paechter (2015) summarized, Butler (1990) argued that

both sex and gender are socially constructed: brought into being via binary gender discourses that inscribe bodies according to a (mythical) duality. This position therefore also ‘queers’ the heterosexist assumptions underpinning dualistic notions of the sex/gender binary. (p. 778)

Research has suggested that in STEM educational communities, particularly in engineering, gender discourses are often rigid and may hinder women’s acceptance, engagement, and persistence by limiting the identities and actions that are commonsensical in these settings (Henwood, 1998; Lynch & Nowosenetz, 2009; Phipps, 2007; Stonyer, 2002; Wolfe & Powell, 2009) – namely, prevailing heteronormative, gendered discourses connect expertise in science and engineering with masculinity and construct binaries which link incompetence and lack of expertise in science and engineering with femininity (De Welde & Laursen, 2011; Harding, 1991; Lie, 1995; Wajcman, 1991). In Western culture, powerful, culturally gendered disciplinary practices produce docile, feminine bodies: acceptable social positions for women often include displays of “frailty, fear, and incompetence” (Goffman, 1977, p. 312), and these practices become even more pronounced, and reinforced, in the specific institutional context of STEM. Studies have strongly suggested that institutions and their agents, including STEM instructors, are a major force in the construction and transmission of traditional binary and heteronormative narratives of gender (e.g., Faulkner, 2000; Foor, Walden, & Trytten, 2007; Ong, 2005; Seron, Silbey, Cech, & Rubineau, 2016).

While less ubiquitous, discourses promoting gender equity, describing a range of gender expression, and encouraging women’s persistence have also been documented in STEM communities (Foor & Walden, 2009). In order to understand how gender hierarchies are enacted and reproduced in STEM educational cultures, as Blackmore and Sawers (2015) argued, “we have to adopt a form of reflexive ambivalence toward the gender binary, treating it as a useful analytic tool,” while also “identify[ing] the necessity to deconstruct the gendered practices and processes that render gender/power relations invisible” (p. 323). Indeed, while many faculty in this study advocated notions of gender equity, the gender binary itself was rarely contested or “queered” in our discussions with STEM faculty, and we acknowledge that by reporting and analyzing this discourse, our work may both resist and reify this binary. Questions of the construct of gender itself fall outside of the scope of this inquiry, but are worthy of deeper exploration and carry important implications for STEM education. Although these discussions raise complicated theoretical concerns, Francis and Paechter (2015) suggested that on a practical level, “If we are serious about fighting entrenched sexism wherever it is found, we need to be able to recognise it, and this requires us to be able to recognise and record differences in the treatment of men and women” (p. 784). Given STEM fields’ long-standing struggles to dismantle gender hierarchies, we suggest that this analysis is an important step in considering how faculty discourses around gender equity may (unintentionally) maintain the status quo.

Methods

Research Sites

As part of a broader study exploring the influence of various pedagogical practices in engineering programs and gendered patterns of academic performance, we purposefully selected three educational institutions as study sites (Maxwell, 2005) based on the following criteria: central emphases on science and engineering, strong engineering program reputation, high representation of female students, similar size, evidence of commitment to undergraduate education, and curricular or pedagogical diversity (lecture and project- or inquiry-based) in their engineering gateway courses. All three institutions are selective, private, higher educational institutions in the United States that offer undergraduate engineering programs. The two small colleges, Chase and Bratton (pseudonyms), boast highly selective academic standards for admission and have relatively diverse undergraduate populations by gender and race (about 40% women and 55% students of color; about 35% women and 50% students of color, respectively). Full-time teaching faculty at both Chase and Bratton are approximately one-third women. Eastern Technical University (ETU) is the largest institution represented, with about 3,000 undergraduates (about 25% women and 20% students of color). ETU is somewhat less academically selective than the two smaller institutions, and the faculty was about 20% women.

Participants

We invited all faculty who taught gateway engineering courses at these institutions to participate in the study, and almost all agreed. The 18 study participants identified as men and women, and were employed at all levels of the faculty ladder (see Table 1; for the purpose of this article we use the terms faculty and instructors interchangeably to refer to the 17 ladder faculty and one graduate student instructor who participated in the study). All participants, except one advanced graduate student, held a Ph.D. in a STEM discipline, and many were trained at top research institutions. All participants taught, alone or in a team, an introductory-level STEM course that served as a gateway to an engineering major; thus all taught at a particularly influential stage in undergraduates' (and particularly women's) decisions to persist in STEM fields (Ferrare & Lee, 2014).

Table 1 Participants by School

	Bratton College	Chase College	Eastern Technical University
Gender	Women, 3 Men, 4	Women, 2 Men, 3	Women, 2 Men, 4
Instructor level	Assistant professor, 1 Associate professor, 4 Professor, 2	Assistant professor, 3 Associate professor, 2	Ph.D. student instructor, 1 Assistant professor, 2 Associate professor, 1 Professor, 2
Discipline	Engineering, 2 Physics, 3 Mathematics, 2	Engineering, 1 Physics, 1 Mathematics, 2 Computer science, 1	Engineering, 3 Physics, 2 Mathematics, 1

Note. To protect participant anonymity in small STEM departments, we identify instructors by gender but not by institution or discipline in the text.

Target faculty were recruited by an email message that asked them to participate in research “studying how students learn and become engaged in introductory STEM courses through a variety of pedagogical and curricular practices.” Faculty were not informed of our particular interest in gender equity before study interviews. This deception was carefully reviewed and overseen by the Institutional Review Board at one of the author’s institutions. Interview questions were designed to be open ended, and the protocol included questions about teaching experiences, values, goals, practices, approaches, and assessments of various students in their courses (Seidman, 1998). See the Appendix for selected interview questions. Interviewers were mindful to avoid leading questions (Seidman, 1998). Interviews were semistructured: interviewers actively invited and openly listened to participants’ descriptions, perspectives, and stories, and sometimes reordered or added questions to follow the flow of participants’ talk or explore statements and examples they raised (Seidman, 1998). Interview questions specifically eliciting responses related to student gender were asked near the end of the interview to allow for more open-ended responses across the interview (Seidman, 1998). Each participant was interviewed one time, and interviews lasted one to two hours. The interviews took place at the faculty members’ home institutions (usually in their offices), were typically conducted by two researchers, and were audio recorded and transcribed.

Data Analysis

Our research utilized tools from critical discourse analysis (Baillie & Douglas, 2014; Case & Light, 2011; Edley, 2001; Willig, 2001) and feminist methodologies (Beddoes & Borrego, 2011; Ropers-Huilman & Winters, 2011) to investigate the ways undergraduate STEM faculty describe and negotiate discourses on student gender to construct teaching identities and positions in relation to gender equity. Given this focus, in-depth qualitative interviews provide a rich data source: interviews allow faculty to put words to implicit models, ideas, and identities they use to frame their roles as educators (Koro-Ljungberg & Douglas, 2008; Quinn, 2005). Importantly, critical discourse analysis centers on identifying participants’ use of sociocultural tools to construct understandings and identities (Willig, 2001); this type of analysis differs from more linguistic approaches to discourse analysis that closely analyze linguistic exchanges in practice (Purzer, 2011). Critical discourse analysis provides an in-depth investigation of the language participants use to understand gendered student expression and the possible rights and duties they have as instructors in relation to gender equity; such analysis allows us to develop theoretical propositions about these social processes (Bryman, 1988; Willig, 2001).

We used a modified version of Willig’s (2001) discourse analysis methodology to identify relevant discursive constructions. We began by reviewing interview transcripts and identifying every instance when a participant mentioned gender (Willig, 2001). We then open-coded all the transcripts for the emergent ways that instructors talked about gender in their work with students – this step entails initially identifying what Boyatzis (1998) calls “codable moments” and provisionally annotating how gender was constructed or used by speakers for each relevant utterance in the interview texts. Then we identified preliminary patterns and grouped similar constructions together into broader categories or discourses, testing these patterns by coding a subset of the interviews using these categories (Boyatzis, 1998; Willig, 2001). We reviewed this subset of coded interviews, iteratively refined the discourse codes, and applied refined codes to all the transcripts. These codes included perception of gender as a limitation; individual differences, not gender; witnessing gender differences; differences are good; praising exceptional women; and acting to change gender inequities.

Next, we investigated the action orientation of these discourses, guided by Willig's (2001) analytic questions: "What is gained from constructing the object in this particular way at this particular point within the text? What is the function and how does it relate to other constructions produced in the surrounding text?" (p. 110). These questions helped us consider what these discourses achieve in the interview space and opened up the next step in our analysis, in which we explored how these discourses linked to various subject positions faculty evoked through their discourse (Willig, 2001). A subject position is a social identity with implicit responsibilities. According to Harré and Moghaddam (2003), a subject position is "a loose set of rights and duties that limit the possibilities of action," constraining "the content of the repertoire of socially possible actions" – in effect circumscribing who one can be in the world (p. 5). We analyzed how faculty produced, according to Willig's (2001) formulation, "discursive locations from which to speak or act" in relation to each of the identified discourses, considering what actions, thoughts, feelings, and realities with respect to gender equity were made possible or impossible by each of these positions, ultimately "construct[ing] social as well as psychological realities" framing "what can be felt, thought and experienced" (p. 111). On a practical level, we identified and grouped the codes by instructors' subject positions, which resulted in the three positioning discourses, and we explored how these positions link to everyday knowledge and practice (Willig, 2001).

Positionality

As qualitative researchers, we acknowledge our own role as the instrument of our analysis: our subjectivities, training, experiences, and curiosities influenced the path of investigation (Luttrell, 2010). Therefore, to promote the trustworthiness of this study, we want to make our positionality as researchers transparent (Luttrell, 2010; Walther, Sochacka, & Kellam, 2013). We identify as middle-class women from a variety of ethnic backgrounds (Asian American, Jewish, White, first-generation immigrant). Three of us have graduate training as educational researchers, one as a physicist, and we all share research interests and perform scholarly work in STEM education and gender. Two of us are mid-career researchers and scholars and two of us are in our early careers. We all have experience teaching undergraduates, and two of us have taught in undergraduate engineering programs.

Trustworthiness

In addition to mindfully reflecting on our positionality across the research process, to further ensure trustworthiness, we adapted Walther, Sochaka, and Kellam's (2013) typology of five fundamental processes for quality in interpretive research to substantiate knowledge claims: theoretical, procedural, communicative, pragmatic validity, and process reliability. To ensure theoretical validity, we aligned our ontological and epistemological positions with our selected research methodologies and analytic approach. Taking up a poststructural, feminist approach, which constructs knowledge as dynamic and subjective, we utilized a form of discourse analysis that evolved from poststructural tenets (Edley, 2001; Willig, 2001), and engaged in a continuous reflexive process across the research, transparently memo-ing on how our own experiences and positionality influenced our approach to the research and interpretation of the data, and naming our subjectivity in presentation of the research findings (Luttrell, 2010). We established procedural validity through purposive recruiting and systematic interviewing of research participants, documenting major analytic decisions, carefully testing and cross-checking our coding against our data to validate our coding schema, and searching for counterexamples (Maxwell, 2005; Maykut & Morehouse, 1994; Seidman, 1998; Willig, 2001).

To promote communicative validity, we utilized an open-ended, nonjudgmental interview protocol designed to elicit participants' understandings and accounts of their everyday practices (Seidman, 1998); we conducted member checks with participants, proposing emergent themes from previous interviews to get their confirmations, elaborations, or disagreements (Lincoln & Guba, 1985; Maxwell, 2005); we explored our analysis with our interpretive community of scholars to ensure that findings were clear and grounded in robust evidence (Cresswell, 2007); and we included thick data in our research presentation to support our findings and allow for alternative interpretations (Ferguson, 2001; Luttrell, 2010; Mishler, 1990). We ensured pragmatic validity by situating our research questions and findings within broader research literatures, by receiving constructive feedback from colleagues, and through the peer review process (Lincoln & Guba, 1985; Mishler, 1990; Walther et al., 2013). Finally, to achieve process reliability, we engaged in systematic research processes: we interviewed participants in pairs to promote data collection quality, created verbatim transcripts of interviews, and maintained an audit trail of memos, coding documents, and analytic drafts that make the path of our analysis traceable (Lincoln & Guba, 1985; Walther et al., 2013; Willig, 2001).

Findings

We identified three prevalent positioning discourses faculty members used to make meaning of students' gender expression and to construct teacher identities. In the first position, gender blindness, instructors in various ways denied perceiving their students' gender, supporting a discourse that gender had no meaning or influence in the classroom. This approach served to maintain tradition-bound teacher identity positions and made interventionist positions to promote gender equity inappropriate, since no particular differences or issues were identified. In the second and most frequent position, gender acknowledgment, participants took up positions of observation, drawing on discourse constructing specific gendered trends in students' performance, preparation, and experiences in college STEM courses. However, this approach again supported tradition-bound teacher positions by suggesting that these gender differences are beneficial for women or by placing action to support gender equity outside the scope of their duties as faculty members. In the third and least prevalent discursive position, gender intervention, instructors took up discourse that identified current practices as broadly detrimental to women, and constructed activist teacher identity positions by describing their own efforts to disrupt bias in their classrooms (see Table 2).

Below we more fully describe and highlight the discursive positions and action orientations faculty discourse made available through the use of representative examples from the interview data. Following the conventions of qualitative research, we include limited examples that characterize larger patterns and trends in the data, prioritizing those that are most illustrative, illuminating, and quickly accessible to readers, to allow room for deep analysis in the text (Kvale, 1996; Maykut & Morehouse, 1994).

Each participant's use of discourse and positioning was dynamic and shifted over the course of an interview. Many participants utilized multiple discourses during our conversations. This pattern aligns with feminist poststructural identity theories, which suggest that a person may unknowingly employ multiple discourses within one conversation and craft shifting, ambivalent identities across discursive moments (Butler, 1990; Wetherell, 1995). Moreover, these discourses are likely only a subset of the many ways these and other STEM instructors construct gender equity issues (Edley, 2001). With these points in mind, we organize the findings below using instructor utterances, rather than individuals, as the

Table 2 Constructions of Gender
Used by STEM Faculty

	Gender blindness	Gender acknowledgment	Gender intervention
Discourses	<p>Gender trends do not exist in their classrooms or in their practice</p> <p>Gender trends as undetectable</p> <p>Role of gender in education is insignificant compared with other forms of difference among students</p>	<p>Identifies specific gendered trends in students' performance, preparation, and experiences caused by forces outside of their classroom practice</p> <p>Examples include stories of successful women, stories of prior inequity, others address inequity</p>	<p>Identifies specific gendered trends in students' performance, preparation, and assumptions of future roles that can be interrupted through classroom practice (individual and group intervention)</p>
Subject positions: roles and responsibilities	<p>Instructors deny perceiving variation in their students' experiences by gender (because gender was not relevant or because they did not have the capacities to detect)</p> <p>Protects position through discourse of unawareness</p>	<p>Instructors acknowledge issues of gender inequity, but suggested causes of inequity were outside of their interactions with students</p> <p>Protects position by recognizing inequity while simultaneously limiting personal responsibility for addressing inequity</p>	<p>Instructors recognize patterns of gender inequity and suggested these patterns were linked to their own interactions with students</p> <p>Protects position by recognizing inequity and displaying efforts to address inequity</p>
Framing of practice	<p>Supports maintenance of current, tradition-bound practice</p>	<p>Supports maintenance of current, tradition-bound practice</p>	<p>Supports active pedagogical intervention to promote equity in practice</p>
Frequency (approximate) of coded gender talk	20%	70%	10%

unit of analysis. This organization enables us to highlight the dominant discourses and linked subject positions that emerged in the data and maintains alignment with our post-structural, dynamic approach (Willig, 2001).

Gender Blindness

Using the discursive position we call gender blindness, several instructors in our study asserted that gender was a nonissue in their classrooms. Some took up discourse that denied the existence of gendered disparities among their students, some claimed they are unable to perceive gendered patterns if any exist, and some argued that any disparities among students are attributable solely to students' individual differences and not to systemic gender bias. This approach resonates with literature on the discourse of color blindness, which documents how a similar, often well-intentioned orientation to "not seeing" race can serve to promote a status quo of

racial inequity in student instruction by failing to acknowledge the ways that racial discrimination remains salient at the individual and societal level (Pollock, 2004). As in the color blindness discourse, these ways of constructing difference made it nonsensical for faculty members to act to promote equity, because gender inequity was constructed as nonexistent or invisible. Therefore, these constructions justify passive, tradition-bound teacher identities. This discursive position represented about 20% of the excerpts of coded gender talk identified in the interviews, and was used by women and men from all three institutions.

In one interview, we asked a male participant how he perceived his male and female students' confidence levels (a contrast invoked frequently in our interviews and other studies, e.g., Corbett & Hill, 2015). After a pause, he responded, "I don't, I don't . . . think there's a distinction. I think there is likely the ones that are timid and not wanting to do it are as likely to be guys as women." Many other instructors simply said there were no differences in experience or performance between men and women in their courses. (While outside of the specific analysis of this article, independent observers collecting data for our larger study did note gendered disparities in participation in classrooms of many of the instructors who took up this discourse.)

Some faculty members asserted that their teaching practices were unaffected by questions of gender equity in STEM or classroom gender dynamics. One female faculty member stated unequivocally that students' intelligence or ability influenced her teaching approach, but that race and gender did not. Similarly, when asked whether he thought his institution was comfortable for women students, one male participant responded, "Yeah, . . . I have no way of knowing, I certainly hope it is, but, uh, I appreciate too that it's, that there are difficulties that I certainly don't see, right?" These instructors' focus on their own fallible perception could be interpreted as a kind of hedge: since they were not aware of difference, there was no rationale that justified acting to promote equity. Moreover, the limitations and subjectivity of perception shielded these instructors from responsibility should others have noticed unaddressed gender inequity among their students.

Through discourse, instructors constructed gender-blind teacher positions in several ways. Some suggested that specific gender differences did not exist in their classrooms or in their practice. Others portrayed gender as undetectable, whether because of their own lack of perception, or because its role in education is insignificant compared to other forms of difference among students. The subject positions and pedagogical roles these instructors took up through these discourses left little room for action to promote gender equity – in these constructions, instructor awareness of gender inequity was a precondition to further discussion or action about gender difference. Gender-blind responses may also indicate the challenge and discomfort many instructors may have felt in discussing gender equity issues. Seeing all students as the same can be beneficial because it promotes equal treatment, but can also, as Bianchini, Cavazos, and Helms (2000) argued, "ignore systematic, institutional forces that constrain students' interests, actions and aspirations" (p. 541). These positions supported the maintenance of systemic gender privilege and left tradition-bound teaching practices un-interrogated.

Gender Acknowledgment

In another group of responses, faculty members acknowledged patterns of gendered variation in student performance, but positioned this variation as outside of their responsibilities as instructors to address. These discursive positions were used by faculty members who identify as men and women from all three institutions and were, by far, the most prevalent in our

data, representing approximately 70% of instances of gender-related talk in the interviews. In their interviews, faculty participants took up discourse suggesting specific gender differences in classroom participation – for example, that women were less confident and quieter than men, that women gravitated toward administrative roles on group projects (e.g., taking notes) while men tended to take computer programming and machine shop duties, and that women sought more instructor feedback and support than their male classmates. Participants also explained that women more often sought help outside of class and were, as one faculty member noted, “disproportionately struggling for whatever reason.” A close analysis of how instructors connected these constructions to their teacher identities suggests that they often acknowledged gender difference in ways that legitimated their passive position toward addressing equity issues.

This section details three variations of this gender acknowledgment position, which recognized that STEM cultures are disproportionately challenging for women, yet disclaimed responsibility for acting to disrupt this pattern. These variations include stories of successful women, which faculty deployed to suggest that gender bias made women stronger; stories of prior inequity, in which faculty argued that influential experiences of gender bias occurred before students arrived in undergraduate courses; and discourse in which faculty argued that gender bias existed on campus and would be addressed by other staff.

Stories of successful women Some faculty characterized gendered patterns of difference among students as having a salutary effect on women students. These participants commended women students for exhibiting, relative to men, a stronger commitment to engineering and willingness to seek out support, as well as superior engagement and work ethic in classes. Instructors suggested that these apparent differences benefited women over men: often using a survival-of-the-fittest logic, these discursive constructions focused on the resilience and strengths of individual surviving women, rather than on any potential downside of this struggle for women students or on the factors affecting their collective underrepresentation in STEM disciplines.

One male faculty member argued that female students’ interests in engineering are likely to be more genuine than those of men, because, as he explained, men were more likely to choose engineering “because that’s what their father did.” He stated,

I tend to think that while the female students are, in general, on average smarter than the male students, or at least more . . . more enthusiastic about their schooling, because the female students were there because they wanted to be, and the male students were there because they need to go to school somewhere.

This participant implied that since engineering is not traditionally associated with women, those who pursued engineering majors were more certain of their commitment. These women were poised for professional success in engineering because they had a deeper intrinsic passion for the field and were less influenced by extrinsic factors. In this construction, the lack of expectation that women would choose engineering, an avowedly traditionally masculine discipline, meant that the women who nonetheless chose to enter engineering programs often outshone their male colleagues. Such discourse suggested that gender bias was a kind of trial, the verdict of which proved these women’s aptitude and fortitude as future engineers. This construction only hinted at the broader social inequality perpetuated by the cultural context that creates this trial process, focusing instead on the positive, boot-strapping attributes and abilities to meet and exceed established standards of success of the individuals who persevere.

Another male faculty member was more overtly critical of male students, suggesting that their gender-specific behaviors often interfered with their own learning and performance. He suggested that men sometimes acted “lazy,” “distract[ed]” the class with “non-sequiturs,” and might ultimately fail the class. In comparison, this participant explained that women were more engaged, hard working, and goal oriented, and thus were likely to perform well in his course. Women students stood out as resilient amid these lackluster men: “The women are working harder for what they [. . .] know what they want and they’re working harder to get what they want.” These constructions did not suggest that men and women differed in their ability to understand course material, but rather in psychosocial attributes that fostered learning among women and hindered learning among men. Taking up an individual rather than systemic perspective, faculty using this discourse positioned themselves as observers of women’s superior learning behaviors in engineering courses, and as purveyors of a status quo education that enabled women’s achievements and men’s struggles. This discourse allowed faculty members to position themselves as advocates for women’s success without requiring any deliberate attention or adjustment in their teaching practice.

Stories of prior inequity Several instructors acknowledged that they noticed gendered patterns that produced inequity among their students, but their discursive framing of gender inequity located the causes, and thus the remedies, outside the purview of the college faculty. In contrast to the examples described above, these instructors noted that women enter STEM programs with less preparation, participation, interest, self-esteem, and confidence than men. They suggested that the causes of these differences lay in students’ prior social and educational experiences – faculty evoked a systemic interpretation of the causes of gender inequity, yet situated those causes outside of their present contexts and teacher responsibilities.

Many instructors suggested that prior education and experiences were to blame for gendered variations in competency and skill. One female faculty member explained,

We can’t control, you know, the previous 18 years of history on these kids. And it’s just a fact that more high school guys come out better prepared for math and physics than high school girls. So there’s nothing we can do there.

Another male faculty member suggested that male and female students “enter with different types of preparations.” He claimed that previous curricular and extra-curricular experiences gave men advantages over women, particularly by cultivating relevant skills such as programming and open-ended mathematics problem solving, and by developing their confidence.

A female participant elaborated on the effect of high school experiences on women’s performance and confidence:

I feel like I want to blame it on the preparation. I think in general, for whatever reason, fewer girls are interested in going into scientific or mathematical fields. [. . .] There’s certainly some differential in preparation, but I think a lot of it, just the same way as they’re coming more often to you, I think they’re also less sure of themselves, and I’m not sure. I mean it’s got to all stem from like high school.

As in the examples above, this faculty member constructed gender inequity in STEM as a trial for women, but unlike previous examples, she highlighted the negative cumulative social effect on women’s outcomes of what she characterized as their “fight.” Later in the interview, the faculty member blamed the poor understanding and competence of K-12 math teachers for some of the specific gender differences among her college students. In both episodes, the

participant positioned herself as having limited ability to influence gender difference or promote gender equity because the effects of poor and inequitable high school preparation were already manifested in her female students' low confidence and preparedness, implying that if women were prepared more like men they would perform better in her courses. Responsibility for change was decoupled from her teacher identity. Like the other discourses that suggested broader structural causes of gender inequity, this construction limited the responsibility of instructors to interrupt gender difference because its causes and effects were socioculturally systemic, began before college, and, therefore, were beyond their influence. This construction allowed faculty members to take up positions in which they both morally objected to gender inequity and limited personal responsibility to enact change.

Others address inequity In the third predominant discourse of the gender acknowledgment position, participants highlighted gender inequity on their campuses, noting a chilly climate for women, debates about negative stereotypes on campus, and what one faculty member called the "ghetto-ization" of small numbers of women on campus (Bebbington, 2002; Murphy et al., 2007). Instructors indicated these differences were problematic, but located these problems outside of their teacher responsibilities and suggested that others were taking action to remedy the issues. For example, one female faculty member identified incendiary debates about gender difference in STEM disciplines on a school-wide listserv in which both students and faculty participate. She highlighted discussions about the ways women were sexualized on campus and disagreements about whether women were, as she explained, "talented" and "desire" careers in STEM fields. While this faculty member identified this listserv as evidence that some women did not feel comfortable in the college environment, she went on to explain how others at the college were addressing the needs of women students by starting "a reading group on women in science." This discourse positioned the faculty member as attuned to the concerns of students and justified her nonactivist teaching identity because other colleagues were taking up the task of responding.

Similarly, another participant suggested that the issue of gender disparity falls under the purview of college admissions, implying that gender bias was fundamentally a numbers issue. After being asked about how comfortable the school environment was for men and women, this male faculty member mentioned the focus among college leadership to raise women's enrollment at the college, which "everyone views as a good thing." He further posited that recruiting a critical mass of female students might limit women's feelings of being, as he described, "freakish" and "ghettoized" on campus. This participant focused on campus demographics and administrative decision making to remedy gender inequity, distancing himself from responsibility to promote change in his position as a faculty member.

Across the examples presented in this section, instructors acknowledged issues of gender inequity, while simultaneously limiting responsibility for addressing inequity in their identities as instructors. As with gender blindness discursive positions, discourse that posited that women performed better than men, or that women excelled in situations of gender inequity, made action for equity a nonsensical component of teacher identity. Those that identified structural or historical causes of gender inequity, or that focused on others' worthwhile responses to support women, separated gender equity efforts from everyday instructional activities. Both approaches positioned instructors to affirm principles of gender equity while resisting the necessity to actively promote change. The prevalence of these discourses in our data suggests that awareness of gender discrimination has gained a common-sense status across these college cultures, yet faculty members did not construct action to promote equity as part of their normative subject positions as instructors.

Gender Intervention

Finally, we identified discourses in the interviews in which instructors recognized patterns of gender inequity and claimed responsibility for promoting gender equity as part of their identity and role as faculty members. These discourses were the least prevalent in the interview data (about 10% of instances of gender-related talk), and were only used by men and women faculty at the two smaller institutions. Here participants constructed gendered variation in student experience in the classroom as indicative of systemic gender inequity in STEM. They positioned themselves as warranted and responsible to interrupt these dynamics through their own pedagogical acts, making action for equity central to their teacher identity positions. While some of the actions they described may be unlikely to effectively meet instructors' goals of promoting gender equity (see Summary section), we suggest that faculty members' willingness to position themselves as responsible actors to disrupt gender inequity is important for addressing persistent gender bias in STEM cultures.

One male faculty member described noticing particular gender differences among his students, and elaborated by highlighting his efforts to interrupt male students' stereotyped assumptions about women in STEM fields. The faculty member recalled interjecting feminine pronouns ("she" and "her") in his descriptions of engineering leaders in class lecture or discussion. He stated, "I'm trying to break them from, because they always assume the boss is a man, or a mathematician is a man." This participant later described efforts to balance the participation of men and women in his class. If he asked for two volunteers to compete in solving a problem, he avoided selecting from the "two men [who] jump up to volunteer." Instead he selected one man and one woman, and he reported, "the women have usually won the thing. Just historically." In describing these pedagogical choices, the faculty member claimed "actively trying to not be too biased." This participant acknowledged his own potential for exhibiting gender bias and described using pedagogical choices to interrupt problematic gender dynamics – in this case the likelihood that male students would more aggressively volunteer to perform in front of the class. Whether or not this intervention, and the discursive shift above, promoted equity is open to question (see Implications below; Mayberry, 1998; Voyles, Fossum, & Haller, 2008). However, for the purposes of this study, we highlight the way the faculty member took up an activist teacher identity and positioned himself as responsible for shifting gender dynamics in the classroom.

The conduct of group work prompted many faculty members' discussions of gender intervention. After one female faculty member described a gendered division of labor in students' small-group work, an interviewer asked whether the faculty member interferes after noticing these differences. The participant explained:

I, sometimes. There was one point where on the one team that I saw that happen that way, more the stereotype way. At one point toward the end of the second project, the guys were going to the shop, the two guys on the team, and the two women were staying in this room and working on their presentation. And after the guys went [. . .] I talked to the women about it and that was reflected in their peer evaluations. Both of the women wrote that, yes, it had been more that way, but they had also made efforts to do this [try out roles outside of stereotypical gendered division of labor], and they have learned this new thing in terms of hands-on skills, so they thought about it. [. . .] So, I point it out more than, I don't insist on it, and I don't think in that case it was, I think if ever the guys or anybody are not letting someone learn and try new

things, I would say something whether it was for gender reasons or something else. If someone was insisting that this was their domain and that nobody was going to be as good at doing this, and they had to do it, I would talk to them about that.

Here the faculty member identified a gendered dynamic that fits stereotypes – male students focused on machine shop work, while female students stayed in the classroom to work on a presentation. While the faculty member in the previous example described an intervention in a class lecture context, this participant recalled observing and talking to individual students – an approach that directly addressed individuals' behavior, but was less visible to the whole class. Again, such an approach may have limited effectiveness – it is particularly striking that the faculty member described holding female students responsible to remediate their behavior and skills to take on typically masculine roles on projects, rather than working with the male students or with the whole class to explicitly shift gender dynamics, as some scholars advise (Bianchini et al., 2000). But, like the male faculty member looking for volunteers, this faculty member portrayed herself as acknowledging gender disparity and actively adjusting her teaching practice to promote parity in women's educational experiences. This discursive move constructed social justice as central to her teacher identity and positioned these actions as a part of a larger orientation towards fairness in the classroom.

One male faculty member described a classroom-level effort to interrupt the kinds of gendered group dynamics that many others addressed individually. After noting women's lack of preparation in computer programming (a gender difference noted but not acted upon in the discourses of gender acknowledgment), the participant described his reasons for governing students' selection of coursework partners. He explained that female students, left to choose their own partners, tended to choose other women who similarly lacked computer-programming skills. He described being explicit in class about the strengths students should seek out in a partner, and ensuring that student pairs possessed complementary skills by requiring students to come to the instructors to, as he articulated it, "bless" their "marriage." This heteronormative metaphor implicitly promoted mixed-gender pairings and may serve to perpetuate, rather than disrupt, gendered normativities (Cech & Waidzunus, 2011). Yet, we highlight it here as an example of a discourse in which the instructor took up an activist teacher identity: he positioned himself as warranted to act to address any gender difference in students' precollege preparation.

Across these excerpts, faculty members reported identifying gender bias and taking steps to actively intervene in these dynamics as part of their teacher responsibilities. Rather than avoid discussing issues of difference or eschewing responsibility for interrupting gendered dynamics, these instructors discursively claimed to perceive particular gender differences in their classrooms, positioned themselves as actively intervening to challenge gender bias through their teaching, and took up active, engaged, student-focused teacher identities.

Summary and Conclusions

In this study, we took a poststructural, feminist approach to explore how faculty discourse about students' gender positioned instructors to reproduce or resist persistent gender bias in STEM fields. We found that faculty members took up three discursive positions in relation to student gender: gender blindness, gender acknowledgment (by far the most prevalent), and gender intervention. Our findings repeat a pattern noted by other research on gender and race discourse across variety of domains, which has shown how, as overt sexism and racism have become less culturally acceptable, subtle discourses and everyday interactions that uphold

systemic inequalities have become more prevalent (Corbett & Hill, 2015; Ong, 2005; Ng, 2007). Some of these discourses claim blindness to gender and racial difference, making sexism and racism public secrets; as a result, these discourses avoid addressing inequity and so reinforce existing power structures (Eisenhart & Finkel, 1998; Williams, 1997). Other discourses deny the existence of systemic inequalities that create hierarchies of privilege in society (Howard, 2006) or deflect responsibility for perpetuating these inequalities by blaming social forces beyond individual control (Sleeter, 1993). Yet, poststructural discourse scholars document the ways that the emergence of counter-discourses, such as gender intervention, can shift common-sense assumptions about social responsibilities and identities in ways that may support more substantial social change (Edley, 2001).

It is notable that the most frequent discursive position taken up by the instructors in our interviews was gender acknowledgment: instructors displayed awareness of issues of gender equity, but did not position the promotion of equity as part of their teacher identities (a finding consistent with other research, e.g. Besterfield-Sacre et al., 2014). Given the heightened attention paid to gender equity in STEM fields over the last two decades, we surmise that these ways of speaking may have been far less prevalent in faculty discourse a generation ago. In these college contexts, faculty seemed aware of issues of gender inequity in engineering, and were able to identify ways gender influences student persistence and success – perhaps a shift that should be celebrated. At the same time, however, their positions of acknowledgment disclaimed responsibility to intervene as a normative part of their faculty member identities. The tools of feminist poststructuralist discourse analysis help shed light on the pernicious nature of systemic gender bias by enabling us to document the nuance in these accounts, as instructors using gender acknowledgment discourse simultaneously claimed commitment to gender equity and evaded responsibility for its perpetuation.

Notably, only faculty members at the two smaller institutions in our study used the intervention discourse. No instructors at ETU took up a discursive position that made action to promote gender equity part of their teacher identities. Though we cannot make generalizable claims, we propose further investigation to consider whether and why intervention discourses may be more prevalent among faculty at institutions like the two smaller institutions. Some research has suggested that undergraduate programs influence women and minority persistence and achievement in STEM (Griffith, 2010), but research has yet to deeply explore the role faculty play in this outcome. Possible factors related to this phenomenon that warrant study include institutional size and culture: researchers could consider whether faculty members at small institutions construct teaching as a more important part of their academic identities or if their teacher identities encompass greater responsibility for recruitment, enrollment, or campus climate than their counterparts at large institutions, and could consider how the relative gender balance among students, the proportion of women faculty members, the presence or success of institutional programs aimed at diversity or equity, and commitment to teaching and emphasis on pedagogical innovation influence faculty discourse and willingness to shift their practice to promote equity.

We also note that participants who identify as both men and women took up each of the gender discourses identified in this study, and women faculty members did not use intervention discourses more frequently than men faculty members. One might assume that women faculty would be more likely to be aware of gender differences and to take up activist teacher identities, but among these participants they were not. Indeed, research has found that both male and female teachers perpetuate gender inequity in STEM disciplines (Moss-Racusin

et al., 2012; Price, 2010) and that, as Turner (2015) has established, marginalized faculty “socialized for success” may reproduce patterns of inequality (p. 351). Our findings suggest that tacit acceptance, and thereby perpetuation, of gender inequity may be part of what some feminist and critical scholars term the “hidden curriculum” of the STEM educational institutions we studied (Blickenstaff, 2005; Ferguson, 2001; McLaren, 1998). We propose further study using critical and feminist perspectives to examine how faculty construct their own gender identities, whether and how they connect their gender identities to their work as educators, how personal background and institutional factors may shape their available subject positions, and how these phenomena may be similar or different in a variety of institutional contexts of engineering education (e.g., public community colleges, small private institutions, large research universities).

Furthermore, we acknowledge some important limitations for this study. As qualitative researchers, we do not aim to produce generalizable findings within a positivist framework. To be clear, we are not claiming that the distribution of utterances (20% gender blindness, 70% gender acknowledgement, 10% gender intervention) in participant interviews is numerically representative of broader patterns among STEM faculty as a whole. Indeed, given the lack of the gender intervention discourse at ETU, it is possible that by broadening our sample, we would have found faculty at that site who took up gender intervention language. Further, we caution that none of the schools we studied are large universities with the highest research activity (R1) and only one of the institutions trained graduate students. It is possible that faculty in these settings, which often valorize research and devalue teaching to an even greater degree, would be less likely to be familiar with student-centered teaching practices and have less incentive to actively disrupt inequitable undergraduate gender dynamics in their classrooms. Rather than make empirically representative claims about the field as a whole, this study aims to build transferable theoretical propositions, given the situated and particular positions of faculty in our sample, about the processes by which STEM faculty discursively construct gender expression and position their responsibilities to promote gender equity, with deep implications for the future of gender equity in STEM fields (Bryman, 1988; Luttrell, 2010; Maxwell, 2005). Future studies could include large research universities, among other institutions (e.g., public and private community colleges) to study the potential transferability of, or challenges to, the findings presented in this article.

Implications

Increases in gender, racial, and ethnic diversity in the engineering fields are crucial both to support the future economy and to promote creativity and innovation (e.g., Corbett & Hill, 2015; National Academies, 2011). Instructors have significant power in college settings to reproduce or interrupt social bias in engineering fields, and thus to help establish environments that support rather than hinder women’s persistence, satisfaction, and success. Instructors are institutional leaders and professional gatekeepers with power to both build and dismantle structures that reproduce inequality and promote the interests of some groups (traditionally white men) over others (often women and people of color; Adelman, 1998; Davis, 2001; Raelin et al., 2014). However, faculty may be unlikely to use this power to promote change unless they construct these actions as common-sense parts of their professional identities as teachers and academics (Edley, 2001).

The discourse patterns documented in this study point to potentially fruitful strategies for making gender intervention positions a more commonsensical aspect of STEM teachers’

identities. First, while most of the faculty members in this study did not construct teacher identities that positioned the promotion of gender equity as part of their pedagogical responsibilities, most did describe challenges that disadvantaged women in their courses and programs. This finding suggests that efforts to promote gender equity have gained traction in universities and that these efforts have made discourses of gender equity accessible to many faculty members. However, familiarity with equity issues may not be sufficient to spur meaningful change in instructors' understandings of their teacher responsibilities and practice (Besterfield-Sacre et al., 2014; Whittaker & Montgomery, 2014). As St. Pierre (2000) wrote,

Poststructural feminists believe that the comfort of imagined absolutes and deep structures allows us, women and men, to avoid responsibility for the state of the world. When we say "that's just the way it is," when we place responsibility on some centered presence, some absolute, foundational principles outside the realm of human activity, we may, in fact, be acting irresponsibly. (p. 484)

As feminist scholars, we call on STEM faculty to view findings of this article as an opportunity to reflect on their own understandings, assumptions, and commitments to promoting gender equity and to exploring constructs of gender more broadly.

As described in the Teaching Diverse Students section earlier, the cultures of many STEM departments devalue teaching: STEM faculty are rarely trained in critical, constructivist, and student-centered pedagogies, which put the identities of learners at the center of classroom practice and call teachers to reflect on the ethical and political implications of teaching (Aydeniz & Hodge, 2011; Besterfield-Sacre et al., 2014; Calabrese Barton & Osborne, 2001; Claris & Riley, 2012; Kreber, 2010; Mayberry, 1998; Riley et al., 2009; Taylor, 2011; Taylor et al., 2002). Faculty members may need more opportunities to take responsibility for their teaching, to prioritize the development of their teacher identities, to identify their own implicit privileges and biases, and to consider the implications of their pedagogical choices for their students and for society (Carnes et al., 2012; Henderson, Beach, & Finkelstein, 2011; Zastavker et al., 2011). Some examples of efforts to broaden faculty discourses and promote forms of equity-oriented teaching include ongoing STEM graduate and early career training on both implicit bias and effective pedagogical practices (Carnes et al., 2012; Devlin, 2006; Taylor, 2011), clear incentives – such as including substantive evaluation of teaching quality and commitment to supporting marginalized students as meaningful aspects of tenure review (Baber, 2015; Brownwell & Tanner, 2012) – and intentional, facilitated dialogue among faculty around equity issues.

Second, while some faculty at the two smaller colleges took up positions of intervention tied to activist teacher identities, the interventions described by these faculty members failed to engage the best practices and epistemological critiques of STEM instruction that have become prevalent in science teaching and feminist literatures (e.g., Calabrese Barton & Osborne, 2001; Taylor et al., 2002). Indeed, even the most action-oriented discourses described in this study may reify gendered and heteronormative constructions of STEM fields and professions. This complication suggests that while faculty members may take more responsibility to promote equity in their classrooms, they may be unable to effect deep change in the STEM disciplines without sustained professional development to more effectively transform their pedagogy (Henderson et al., 2011). This pattern parallels research in higher education that suggests that shifts in teacher identities, cultural models of teaching,

and attitudes may be an important step in pedagogical change, but these are often more effective when accompanied by training in specific teaching techniques and practices and with broader institutional and disciplinary shifts that value effective, equitable teaching as part of faculty members' professional identities (Allen-Ramdiel & Campbell, 2014; Borrego, Froyd, & Hall, 2010; Brownwell & Tanner, 2012; Eley, 2006; Kreber, 2010; Whittaker & Montgomery, 2014).

As faculty embrace positions that challenge traditional practices and claim responsibility for promoting gender equity, they need support and access to pedagogical discourses and practices that help them do so more effectively. In this study, participants often implied that women needed to become more like men to succeed – for example, suggesting that women need to boost their confidence and change their precollege preparation to replicate that of their male peers, or be more willing to aggressively compete for attention or resources (Beddoes & Borrego, 2011; Faulkner, 2000). Feminist scholars frame such discourses as legitimating reformatory rather than transformative interventions. Reformatory efforts aim to make content more appealing to women and minorities, while retaining the traditional hierarchies of the disciplines (Capobianco, 2006; Mayberry, 1998). Even those faculty member participants who voiced the most ardent commitment to changing gender dynamics described pedagogical actions that failed to substantively challenge the gendered status quo. For example, the blackboard competition intervention described by one faculty member can be read as a reformatory intervention, which required women to adapt to and succeed in a culture of aggressive masculinity. Although the participant described this contest as an effort to upend assumptions that men are more competent problem solvers, his story nonetheless perpetuated and even idealized a competitive climate and traditional conceptions of success and winning that women in STEM classes often report as alienating (Acker, 2006; Voyles et al., 2008). Transformative change, advocated by feminist philosophers of science, instead aims to make room for women and minorities in science and to transform the very nature of science; such change will foster more critical approaches to teaching and learning, which open up the activities of science to bodies, emotions, and subjectivities (Claris & Riley, 2012; Harding, 1991; Mayberry, 1998; Riley et al., 2009). Faculty members who take up activist, interventionist teaching identities may also need training to reflect on the gendered student identities implicitly valued in their practice, and may need support to institute concrete, transformative practices in their classrooms (Bianchini et al., 2000; Carnes et al., 2012; Lynch & Nowosenetz, 2009; Mayberry, 1998).

Feminist education scholars Kenway and Willis (1998) suggested that gender reform is a “discursive field within which meanings about gender reform itself [are] constantly negotiated and contested; a field in which truths are made and remade” (p. 206). Now that faculty members more commonly construct gender inequity as visible and problematic, we encourage efforts to support more faculty to go beyond observing difference by intervening to promote equity. For this shift to take shape, institutions must support STEM faculty members to develop more engaged, student-centered, and critical teacher identities and to adopt transformative practices that support learning and engagement for all students in their classrooms (Besterfield-Sacre et al., 2014; Borrego et al., 2010; Kezar, Gehrke, & Elrod, 2015). By encouraging more expansive discourses and practices in STEM classrooms, academic communities can help transform STEM fields into more inclusive, equitable, and visionary communities.

Appendix

Selected Questions from the Faculty Interview Protocol

What is it like to work here as a faculty member? What does it mean to have a successful career at [school]?

What do you hope that students ultimately learn from your course?

What teaching strategies/methodologies did you use to help students learn/achieve your learning objectives?

What role do you perceive you have as an instructor when you teach in front of your classroom? Can you use a metaphor to describe your role?

Give an example of the most recent class in which your role as an instructor was exhibited in an exemplary way.

Can you tell me a little bit about the students who come to [school]? How would you describe a typical [school] student?

Can you describe your relationship with your students?

How, if at all, have the demographics of the student body influenced how and what you teach? What types of students seem to excel/struggle in your class?

Have you noticed any differences in the ways male and female students participate in your class? In what ways, if at all, do you interact differently with male and female students?

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