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## Are STEM Syllabi Gendered? A Feminist Critical Discourse Analysis

### Abstract

This study explored the gendered nature of STEM higher education institution through a feminist critical discourse analysis of STEM course syllabi from a Midwest research university. I explored STEM syllabi to understand how linguistic features such as stance and interdiscursivity are used in the syllabus and how language and discourses used in the syllabus replicate the masculine nature of STEM education. Findings suggest that the discourses identified in the syllabi reinforce traditional STEM academic roles, and that power and gender in the STEM syllabi are revealed through exploration of the themes of knowledge, learning, and the teaching and learning environment created by the language used in the syllabus. These findings inform and extend understanding of the STEM syllabus and the STEM higher education institution and lead to recommendations about how to make the STEM syllabus more inclusive for women.

### Keywords

Critical Discourse Analysis, Feminist Research Methods, Poststructuralism, Syllabus, Syllabi, STEM Education

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## Are STEM Syllabi Gendered? A Feminist Critical Discourse Analysis

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Both individual and institutional discrimination still exist in Science, Technology, Engineering and Math (STEM) higher education, but embedded inequalities have largely replaced more visible forms of discrimination (Monroe, Ozyurt, Wrigley, & Alexander, 2008). Research suggests that the marginalization of female students and faculty persists in STEM education because of institutional factors (Cantu, 2012; Griffith, 2010; Linley & George-Jackson, 2013; Mayberry & Rose, 1999); discrimination is institutionalized through texts, policies, practices, and unwritten norms (Acker, 1990). Institutional texts, such as the syllabus, coordinate the day-to-day work of those within the institution and serve as a link between the local and ruling relations (Campbell & Gregor, 2004).

The syllabus reflects the institutional values and discourses of STEM academics as a document created to inform and guide students as they pursue a STEM education; as such, a critical discourse analysis of the language used in the document to coordinate student work can reveal entrenched inequalities in STEM education (Biber, 2006a). This study explored the gendered nature of STEM in higher education through a feminist critical discourse analysis of STEM course syllabi. Through this discourse analysis, I sought to understand if and how STEM syllabi are gendered; the analysis and findings informs and extends understanding of the STEM syllabus and STEM education.

Calls for research to understand the existing social and scientific systems that marginalize women in STEM fields at the institutional level have increased in the recent years (Cantu, 2012; Griffith, 2010; Linley & George-Jackson, 2013; Mayberry & Rose, 1999). This study responds to those calls for research by exploring the STEM syllabus. By understanding if and how the syllabus is gendered through a feminist critical discourse analysis, this study extends understanding of how STEM higher education marginalizes women and has the potential to make recommendations to ameliorate those factors both through changes to the syllabus as well as to the institutional culture that perpetuates it. To inform my analysis of the genre of the syllabus, I began by exploring the linguistic features of the syllabi. Specifically, I explored how linguistic features like stance and interdiscursivity were used in the corpus of syllabi explored; how is power reflected in the syllabus through the use of pronouns, and what

linguistic tools and discourses are used to perpetuate the gendered nature of the STEM classroom.

### **Conceptual Framework**

This study was framed through the lens of poststructuralist feminist thought to provide a lens through which I explored how power is gendered (Hesse-Biber, 2014). Poststructuralism “rejects objectivity and the notions of an absolute truth and single reality,” and “knowledge is complicated, contradictory, and contingent to a certain social context and historical context” (Hesse-Biber, 2014, p. 44). For poststructural feminists, emphasis is placed on language and discourse, “regarded as constitutive of experience and not simply representative of it” (Hesse-Biber, 2014, p. 44). As such, discourse analysis is a key tool of poststructuralist researchers because the link between power and knowledge can be seen by exploring language-in-use (Hesse-Biber, 2014; Lazar, 2005). Analysis of texts looks for practical ideologies to uncover what is framed as logical ways of thinking that, in reality, perpetuate inequality (Hesse-Biber, 2014). Since patriarchal gender ideology is structural, it is enacted in institutions and reflected in institutional texts, therefore, “The task of feminist CDA is to examine how power and dominance are discursively produced and/or resisted in a variety of ways through textual representations of gendered social practices” (Lazar, 2005, p. 10). Through a framework of poststructuralist feminist thought, this discourse analysis uncovers the ways that gendered practices that favor men are represented and replicated in the syllabus.

### **Gendered Organizations**

The concept of gendered organizations informs this proposed exploration of STEM education. Gender is present in an institution’s policies, distribution of power, practices, images, work ideologies, and processes (Acker, 2000; 2012; Britton, 2000; Britton & Logan, 2008). Understanding institutional processes as gendered helps to explain gender inequalities in organizations (Britton, 2000). The modern organization is gendered through a substructure that,

consists of processes and practices of organizing that continually recreate gender inequalities. These processes and practices are supported by organizational cultures and reproduced in interactions on the job, shaped in part by the gendered self-images of participants. These gendering processes are, at a less visible level, supported by gender subtexts of organizing and a gendered logic of organization that link the persistence of gender divisions to the fundamental organization of capitalist societies. (Acker, 2012, p. 218)

Gender discrimination persists at all levels of higher education, especially STEM education, because the institution is structured according to male norms and standards,

The segregation of academic disciplines and institutions, the construction of faculty and administrative roles in ways that are more consistent with men’s lives, and the maintenance of evaluation processes that disproportionately value the disciplines and activities that men dominate are all examples of how university structures and associated cultures and practices are gendered. (Bird, 2011, p. 208)

Within STEM education, a binary system persists in language that reinforces dualisms such as men and women, competition and collaboration and active and passive (Yakaboski, 2011). These binaries place men at the center with women and their actions and behaviors continually referenced as off-center or as recognizable and definable because of their difference from men (Yakaboski, 2011). The language used in higher education reinforces and reproduces stereotypical gendered roles while establishing lower expectations for men and installing higher, often unachievable ones, for women (Yakaboski, 2011). Informed by an understanding of institutions as gendered, through a lens of poststructuralist thought, this discourse analysis seeks to reveal the entrenched inequalities of STEM education through the language used in the syllabus.

### The Syllabus as a Genre

The genre of the syllabus is a written modality created for students and indirectly for faculty and administrators (Afros & Schryer, 2009; Strauss & Feiz, 2014). As a document for students, the syllabus typically has several goals: first, it motivates and structures student learning; second, as an organizational/administrative document, it acts as a guide for the course (practical and intellectual); third, as a communicative document between faculty and students, it outlines the course of study, course components (schedule, assignments, activities, assessments), course goals, objectives, outcomes, and expectations for success; fourth, as a preventative document, it addresses student questions and concerns and expectations for behavior; fifth, as a social document, it facilitates the socialization of students into the academic discourse community; sixth, it asserts the faculty member's authority as a teacher; and, seventh, it familiarizes students with new discursive sites (Afros & Schryer, 2009; Doolittle, 2010; Thompson, 2007). It is also a document for other faculty and administrators, as proof of the instructor's professionalism and course quality, successful teaching experiences, and professional identity reconfirmation (Afros & Schryer, 2009). Although syllabi vary in the length and depth of the information they contain, most contain information that falls into each of the following categories: instructor information, course information, grading information, and policy information (Doolittle, 2010).

Linguistically, syllabi convey the instructional, communicative and social goals discussed above through stance, intertextuality, and pronoun use. First, Biber (2006a) found in his analysis of university language that written management registers use stance to tell students what to do, seen as statements of veracity or the likelihood that something will happen (Biber, 2006a; 2006b; Strauss & Feiz, 2014). Stance is the, "speaker's or writer's feeling, attitude, perspective, or position as enacted in discourse" (Strauss & Feiz, 2014, loc 5583). One way stance is conveyed in syllabi is through the use of modal verbs (Afros & Schryer, 2009). For example, obligation modals ("must" and "should") indicate student obligations and possibility/permission/ability modals ("may" and "can") state rules and requirements for students (Afros & Schryer, 2009). Additionally, syllabi also indicate stance through the use of imperatives (**Come** to class on time), which are often strengthened by a negative (**Don't expect** to get an A without doing the assigned readings) (Afros & Schryer, 2009). Imperative mood is used in syllabi to imply obligation to students without the politeness that is seen through the use of modal verbs like "may." Finally, syllabi also convey stance through the use of hedges (**Roughly**, we will cover the foundations of feminist thought in the second week) (Afros & Schryer, 2009). The use of hedges leaves space for negotiation in obligation or possibility statements (Afros & Schryer, 2009).

While stance typically conveys obligation and permission, which delineates what students can and cannot do, pronoun use in the syllabus has been found to be indicative of the power relationship in the classroom (Afros & Schryer, 2009; Baecker, 1998). Baecker's (1998)

exploration of higher education syllabi found that there is power implicit in the choice between the use of “you” or “we,” “when I demand that you do something, I am not hiding my (however genuine or illusory) authority or power to command” (Baecker, 1998, paragraph 10). When using “we” in the syllabi instead of “you” (e.g., **We** will develop an understanding of... instead of **You** will develop an understanding of...), Baecker (1998) hypothesized that the instructor was hiding the power relationship between the faculty member and the students by implying that they were equals. According to Baecker (1998),

We is a rhetorical device that allows the speaker(s) to distance themselves from whatever is being said, thus making it more palatable because it appears to come from the group as a whole rather than from a particular individual (paragraph 14).

In reality, the power relationship placed students as subordinates to faculty as they would be the ones doing the work and the faculty would be the ones assessing them (Baecker, 1998).

Finally, the genre of the syllabi uses intertextuality and interdiscursivity to connect the document and students to the larger STEM higher education institution. Intertextuality is, “the explicit and implicit relations that a text or utterance has to prior, contemporary and potential future texts” (Afros & Schryer, 2009, p. 225). For syllabi, the texts commonly referenced to are class lecture and tutorials, textbook and assignment instructions, scholarly publications and research projects carried out by instructors, and institutional policies such as academic misconduct (Afros & Schryer, 2009). Second, interdiscursivity is the use of elements in a text that carry institutional and social meaning from other discourses (Afros & Schryer, 2009). Syllabi reflect the conventions, values and practices of neighboring discourses and communities that are identifiable, in part, through content-specific terminology (Afros & Schryer, 2009). Specifically, the discourses that syllabi refer to are college teaching (e.g., learning objectives) and discipline-specific languages/terminology (Afros & Schryer, 2009). Connecting to larger discourses about STEM education and teaching is often accomplished through interdiscursivity. Interdiscursivity and intertextuality relate the syllabi to STEM education and institutional practices.

## **Gender**

Although limited research has been conducted on the gendered nature of the STEM syllabi, poststructuralist feminist thought provides insight into the exploration of STEM syllabi as gendered. Through a poststructuralist lens, it is possible to make a comparison between a modernist view of knowledge as based on notions of absolute truth and a single reality, which is masculine, and the social construction of knowledge, where knowledge is unstable and informed by context (Hesse-Biber, 2014). Traditionally, epistemic privilege has been located in academic disciplines, “The disciplinary training of many physical scientists eschews alternative paradigms of knowledge production and produces structural challenges to thinking and researching outside of these frames” (Hesse-Biber, 2014, p. 23). The view of knowledge as socially constructed challenges the modern male concept of power (Hesse-Biber, 2014).

The analysis of how knowledge is presented in the syllabi informs analysis of how learning occurs. Traditionally, the view of education, especially science education, was that the job of the teacher is to be the all-knowing expert who deposited his knowledge into students (Mayberry & Rose, 1999). A view of knowledge as absolute or static results in a view of teaching that follows the “banking” pedagogy, where knowledge is deposited by the teacher and retrieved on examination day (Elias & Merriam, 2005). Students, in this model, are passive recipients, and their job is to learn the knowledge. The traditional teaching method is lectures

and assessments are primarily quizzes, midterms, and exams. In contrast, a more dynamic view or subjective of knowledge views knowledge as something that students need to engage with to learn, which may be reflected in more progressive or critical pedagogies (Elias & Merriam, 2005). This is reflected in syllabi through collaborative and active learning, and advanced cognitive skills like application and analysis. Within the syllabi, statements about knowledge as static and teaching methods that reflect that epistemological belief reinforce the existing male hierarchy (Mayberry & Rose, 1999). Through a poststructuralist lens, one way to explore the gendered nature of STEM syllabi, especially in the absence of gendered cues that may occur more often in spoken communications, is by examining the syllabi for these more subtle indications of how knowledge, teaching, and learning are viewed (Hesse-Biber, 2014).

In addition to an epistemological exploration of STEM syllabi language, an additional way to explore syllabi as gendered is by an exploration of the teaching and learning environment through the language used in the syllabus. One of the reasons cited as causing the gender gap in STEM education, where women are more likely to change their major to a non-STEM field, is the masculine environment of STEM higher education that creates a classroom environment that is male-normed, highly impersonal, and individualistic (Morganson, Jones, & Major, 2010; Vogt, Hocevar, & Hagedorn, 2007). Called a “chilly climate,” this leads to a classroom environment that is not welcoming, inclusive or supportive for women (Vogt et al., 2007). Examples of STEM classroom practices that contribute to a chilly climate are weed-out courses, courses that grade on a curve, a competitive environment, reliance on lecture as a teaching method, an individualistic culture, and comprehensive exams (Mervis, 2011; Morganson et al., 2010; Shapiro & Sax, 2011). For this discourse analysis, I explored STEM syllabi for language use that perpetuated a chilly climate or the practices that have been found to cause it.

## Methods

Through the framework of feminist critical discourse analysis, I examined STEM syllabi semantic and pragmatic content to understand how institutionalized power and dominance are negotiated through language (Lazar, 2005). First, I explored the nature of the genre of the STEM syllabus and the use of modal verbs and pronouns to compare and extend the research conducted on the syllabus (Afros & Schryer, 2009). Second, I looked for linguistic patterns in the use of modal verbs, pronouns, and interdiscursivity in the syllabi to identify institutionalized STEM higher education power and gender relationships (Lazar, 2005). The corpus examined in the present study is STEM syllabi from a Midwest public university, selected to limit the corpus to syllabi from the same institutional environment.

### Corpus Creation

To create the corpus of syllabi for exploration, I began by searching for STEM syllabi that were publicly available through the university website. Second, I identified all publicly available STEM syllabi dated 2010 or newer, a total of 18 syllabi. Third, I eliminated one online syllabus, to keep the modality constant, and one lab syllabus. Fourth, I refined the sample so I only had undergraduate syllabi and each instructor only had one syllabus in the corpus, so that I did not bias the sample towards a certain faculty member’s views of education. The final corpus consisted of eight STEM syllabi, two from math, two from chemistry, two from biology, one from physics and one from geology. The shortest syllabus was one page long (Upper level physics), the longest was four pages (Lower level geology), the remaining were two or three pages long.

## Data Analysis

After importing the syllabi into ATLAS.ti, a qualitative data analysis software, I explored each syllabus to understand the genre of the syllabi in the STEM fields and identify how power and gender were negotiated in the syllabi. I explored the syllabi for discourse features that were identified in the literature as specific to the syllabi genre, as well as to identify discourses and linguistic tools that illuminated the power/knowledge and gendered nature of the STEM institution. To do that, I began by categorizing the different content areas as defined by Doolittle (2010) into four categories: (a) Instructor information; (b) course information; (c) grading information; and (d) policy information. Second, I looked for indicators of stance such as modal verbs (must, should, may and can) by searching each syllabus for those modal verbs. Third, I looked for how power was negotiated through the use of pronouns. To identify pronoun use, I coded each instance of the pronouns “you,” “I,” “we,” and “our.” Finally, I explored the use of interdiscursivity in the syllabi and specifically explored those discourses indicative of gendered power at the STEM institutional level. Although I did a final in-depth reading of each syllabus to code for interdiscursivity and indications of gendered power, I also identified discourses and indications of gender through my researcher’s journal and field notes that I took throughout the coding process. The dominant discourses identified were those of college student, college teacher, and mathematician/scientist, identified by looking for terminology that was specific to those discourses (e.g., “learning objectives” for college teacher and scientific terms for scientist). Additionally, the gender themes identified in the analysis were the view of knowledge (i.e., static or dynamic), understanding of learning (i.e., banking, such as quizzes and tests, or constructivist, such as discussion and collaborative group work), and for the creation of a chilly climate. Through that analysis, I was able to respond to the research questions that guided this analysis and understand how power and gender were represented and replicated through the syllabus.

## Validity/Ethics

In discourse analysis, specifically critical discourse analysis, “validity is not constituted by arguing that a discourse analysis *reflects reality* in any simple way” (Gee, 2014, loc 3397). Discourse analysis is an interpretation, and, therefore cannot be assumed to be universally applicable or infallible (Gee, 2014). However, trustworthiness of data analysis and findings should still be sought; according to Gee (2014) discourse analysis validity has four elements: convergence, agreement, coverage, and linguistic details. First, to seek convergence, I explored the data according to multiple linguistic points so that I could examine if responses to different analysis questions supported core findings and reinforced each other (Gee, 2014). Second, to verify linguistic details, I framed the analysis and reporting tightly to the different linguistic structures identified in the literature (Gee, 2014). Third, I sought to validate findings and analysis through agreement with peer debriefing as a part of writing process (Gee, 2014). Finally, because of the scale of this study, it was difficult to confirm coverage by applying to related sets of data, but the analysis was informed by the corpus of university language (Biber, 2006b) to seek convergence with research on the different types of written university registers (Gee, 2014). Finally, to reinforce the validity and trustworthiness of this exploration, I triangulated my findings with the literature and other syllabi (Maxwell, 2013).

To ensure that data collection, analysis, and reporting were conducted in an ethical manner, all syllabi found were available through a public online search. Confidentiality was protected through data analysis and reporting. Instructor identities were not identified in the written report of this study’s findings, and each course referenced in the report is only identified by the course subject of study and course number.

## Findings

Through careful reading and re-reading of the data according to the data analysis steps outlined above, I was able to develop an understanding of the nature of the STEM syllabi and develop an initial understanding of how it is used as a gendered document that replicates the dominant male discourses prevalent in STEM higher education. My analysis suggests that the STEM syllabi explored had many of the same linguistic features and content categories previously identified in the literature, that the discourses identified in the syllabi reinforce traditional STEM academic roles, and that power and gender in the STEM syllabi are revealed through exploration of the themes of knowledge, learning, and the teaching and learning environment created by the language used in the syllabus.

### Course Content Categories

This exploration of the genre of the syllabi as it was represented by this corpus was guided by Gee's (2014) recommendations to look at a genre and ask how the language is used to get others to recognize what is going on. For the syllabi studied, the inclusion of the four content categories defined by Doolittle (2010) helped to define the documents as syllabi. The content in each syllabus fell into the four categories; most began with basic course information and instructor information such as the name and location of the course and contact information for the instructor. Instructor information was usually brief and provided directions for students to contact them to seek help. In some cases, the instructor information included more detailed information about how students could contact them. For example, "It is generally better for me if you come to see me during my posted office hours rather than at other times. If necessary, we can set up an appointment" (Upper level mathematics). The second category, course information, varied more from course to course, but all syllabi included information about when and where course meetings would be held and learning objectives. Course information also included varying levels of information about how students should behave in the course to be successful, which included study tips, general education requirements, textbooks, course content, and course schedule. As a category, it comprised the most content and also made up the largest part of each syllabus.

The third category, grading information, was also a standard in the syllabi, and typically followed a similar format. More variety was seen in how the actual decisions about grades were made. For example, some made statements about extra credit, "Extra Points: The instructor may award extra points (up to 20 pts) for participation. A student cannot jump two letter grades with the extra points" (Upper level chemistry). Content in the final category, policy information, also did not vary within this corpus of syllabi. With the exception of the upper level physics syllabus, all contained the institution's policies about academic dishonesty, accommodations for disabilities, and statements about essential studies (general education) and student services. Each syllabus also had policies about attendance and late work, which were similar across the corpus. Overall, this corpus of syllabi largely represented similar types of information that fell into each content category and aligned with prior research on syllabi content.

### Stance Through Modal Verbs

To understand how information and the instructor's expectations are communicated through the syllabus, I explored stance through the use of modal verbs such as "will," "may," and "can." In the corpus of this syllabi explored, "will" was mentioned 120 times, the most frequent of the modal verbs used, which aligns with prior research (Afros & Schryer, 2009).

In this corpus, “will” was used to indicate what should happen from the instructor’s perspective (e.g. making course content available, grading a certain way), “scoring **will** follow these guidelines” (Upper level biology) and “you **will** be notified in advance of when homework and quizzes will be due and what topics will be covered” (Lower level biology). This use of “will” implies a prediction of what the instructor will do and aligns with the findings of Afros and Schryer (2009) who found that the use of modal verbs in the syllabi communicated the space left for negotiation. “Will” implies future certainty, although some flexibility because it is intended to happen in the future, and therefore is not certain (Afros & Schryer, 2009).

The second modal verb used to imply stance in this discourse analysis is “may” which occurred 25 times. In the syllabi explored in this analysis, the most frequent use of “may” indicated a future event or diminished the impact of a directive. For example, “The information presented here **may** be modified to fit the needs and time constraints of the course,” (Lower level biology) indicates a future event. “May” is also used to diminish the impact of a directive, such as, “you **may** not use calculators, telephones, computers, or similar electronic devices during exams” (Upper level math). The use of “may” to imply future events or to lessen the impact of a directive aligns with prior research on the use of “may” in syllabi, “the syllabi in the present corpus relied on the permission meaning of may to state rules and requirements for students and the possibility meaning of “may” to inform students of required actions” (Afros & Schryer, 2009, p. 229).

The third modal verb explored in the analysis of stance in syllabi is “can” which was used ten times in this corpus of syllabi to imply permission, ability or a choice (Biber, 2006b). For example, the use of “can” implies permission in the following example, “the quizzes **can** be completed in the computer lab in Chemistry department” (Upper level chemistry). This statement gives students permission to complete the online quizzes in the computer lab but does not tell them that they are required to take them there. Second, the use of “can” implies ability in this statement, “in this way, you **can** become an owner of knowledge, not just a memorizer of facts” (Lower level geology). This statement implies that students are able to learn the content material. Finally, the use of “can” implies choice in the following statement about additional points earned through extra credit, “that **can** be used to replace any single pre-quiz” (Upper level biology). This statement communicates that students have the choice to decide which quiz grade they would like to have replaced. Although used less frequently than “will” and “may,” “can” is still a powerful verb in the syllabi explored in this analysis, providing direct insight into what students are empowered to do in the course. The use of modal verbs in this corpus of syllabi aligns with prior research on stance and the use of modal verbs and syllabi: “Will” is used to imply prediction as is the more polite “may;” “May” is also used to indicate future events; finally, “can” is the clearest indication of the initiative of students in a course, implying what they are able to do and what choices they have. Their power in the classroom is further explored when exploring the use of pronouns.

## Pronouns

The linguistic tool that provides insight into intended perception of the nature of the power relationship between the instructor and students in the syllabus is by exploration of pronoun use. In this corpus of syllabi, “you” was the most prevalent (used 178 times), followed by “I” (used 26 times), “me” (used 21 times), “we” (used 14 times), and “our” (used 4 times). The use of “you” and “I” were used in the syllabi delineated between what would be expected from students and what the instructor would do or provide,

If **you** absolutely must miss a test for some valid reason (oversleeping is not a valid reason to miss a test) it is **your** responsibility to contact **me** to schedule a

makeup. **I** will normally expect to hear from **you** before the scheduled time for the test (Lower level math).

The use of “I” and “you” in this corpus reinforces the intention of the syllabus to be a contract between the instructor and student by outlining what each will be responsible for. This use aligns with the literature; the use of “I” and “you” makes the power relationship between the instructor and the students clear; the instructor sets the expectations and the students must fulfill them (Afros & Schryer, 2009; Baecker, 1998).

In contrast to the use of “I” and “you,” the power relationship between the instructor and students is hidden through the use of “our” and “we.” In this corpus of syllabi, “we” and “our” functioned to conceal the power relationship and create a feeling of solidarity.

**We** will not have time in this class to devote to prerequisite material (Lower level math).

**Our** final exam will take place at the following time in **our** usual classroom (Upper level math).

The use of “we” in this corpus could be an attempt to create solidarity, by presenting course work as a collaborative effort. However, course work is typically selected and guided by the instructor, and the use of “we” conceals that aspect of instructor power, which aligns with Baecker’s (1998) findings, “The pronoun we is an example of an ambiguous marker of power, which can be used both to indicate solidarity or community and as a means to coerce the audience into behavior that benefits the speaker” (Baecker, 1998, paragraph 7). In this corpus, “we” is used relatively few times, and more often replaced with “instructor(s)” or “I,” which according to Afros and Schryer (2009) shows a more clear distribution of power within the syllabus.

### **Interdiscursivity**

Exploring interdiscursivity required identification of textual elements that have institutional, cultural and social meanings from other discourses, “syllabi are interdiscursive for they reflect conventions, values, and practices of neighboring discourses and communities” (Hyland, 2004, p. 108). The main discourses referenced in this corpus were mathematic/scientific professional, college teacher, and college student. First, the discourses of mathematic or scientific professional that were included in the syllabi were identified through the use of field-specific terminology. The terminology used in the syllabi included mathematics and science technical terms, which were seen in course/learning objectives and course schedules. While science terminology was limited to science syllabi, mathematic terminology was seen throughout science syllabi.

The second and third discourses referred to in the syllabi were college teacher and college student. The syllabus is a document used as evidence for instructors of effective teaching which references the discourse of college teaching (Afros & Schryer, 2009). Evidence of the discourse of college teaching was seen in the use and wording of course objectives such as “Students will be able to...” and the use of action verbs like apply and analyze to explain how students would demonstrate content knowledge. Course learning objectives or outcomes were included in each syllabus. Another indicator of the discourse of college teaching was seen in language about effective learning, such as descriptions of active and collaborative learning. Finally, the syllabi reinforced and, in some cases, constructed the expectations of being a college student, “I haven’t done my job if all I do is read the book to you; you haven’t done

your job if all you do is fill a chair every day” (Lower level math). Each syllabus defined appropriate student behavior by outlining expectations for students outside of course requirements, which included instructions such as “buy a stapler” and how students should study or read the textbook.

## Gender

Initial exploration of the STEM syllabi in this study did not reveal overt references to gender, such as through the use of gendered pronouns. However, upon deeper review, language used in the syllabi reflects institutionalized STEM teaching practices and views about knowledge that are inherently discriminatory to women and minorities by promoting a view of knowledge as static and unchanging, a view of teaching that promotes the idea of a passive student, and by promoting a chilly climate that marginalizes women. First, the STEM syllabi explored in this analysis promoted the male-biased STEM institution by reinforcing views of knowledge as static and unchanging, as it is traditionally considered to be in science, which is a masculine concept of knowledge (Mayberry & Rose, 1999). Syllabi promote the positivist view of knowledge by suggesting that there are correct conclusions that can be drawn with the right tools:

A critical thinker considers all available evidence with an open mind and uses appropriate techniques to analyze that evidence and reach a conclusion (Lower level geology).

The main goal is to **attain** knowledge and comprehension of major concepts and techniques of organic chemistry (Upper level chemistry).

As these examples show, the STEM syllabi explored in this study demonstrated a view of knowledge that was to be acquired by the student, which promotes a view of knowledge as unchanging. This is further reinforced by the use of adverbs to imply certainty such as “actually” and “in fact” which are used in syllabi to identify information as factual and beyond dispute (Biber, 2006a; 2006b). For example, “draw accurate **conclusions** from scientific data presented in different formats” (Lower level math). Instead of promoting the idea that knowledge is constructed by the student and dynamic, subject to change as it would in a more feminist view of knowledge, the syllabi reinforce the larger male-dominant view of knowledge as one that students acquire and use make the correct decision.

Related to how knowledge is represented in the syllabi is the teaching methods and learning activities selected by the teacher and described in the syllabus. This corpus of syllabi provided a mixed picture of views of learning. On one hand, the assessment measures used in each syllabus were quizzes, midterms, and exams. Additionally, some course objectives placed the focus of the course activities on the instructor, “to teach you how to solve some basic partial differential equations and boundary value problems. To teach you some of the basic properties of Fourier series” (Upper level math). However, some syllabi promoted learning as a dynamic activity, “Be able to apply ecological theories and knowledge to understand the world around you” (Upper level biology). This corpus of syllabi made some accommodations for knowledge as constructed, but not for the possibility that scientific knowledge is subjective.

Many syllabi attempt to create an active learning environment, but those attempts conflict with commonly accepted discourses of STEM higher education and even the STEM teaching community. For example, we see in the lower level math course description what seems to be a nod to critical thinking and even the idea that knowledge is not static,

The ability to think and reason effectively is essential in most endeavors, a critical thinker considers all available evidence with an open mind and uses appropriate techniques to analyze that evidence and reach **a conclusion**. In this class you will be given the opportunity to learn some of those techniques, to recognize situations that call for their use, and to **use them effectively** in a variety of settings.

At first, the course purpose statement presents a view of knowledge as constructed by suggesting that there is a possibility that different conclusions can be drawn from the evidence by the choice to use “a” instead of “the” conclusion. However, the second sentence indicates that the techniques to analyze the evidence, once learned, are to be used instead of applied. This indicates that the knowledge of the tools, as well as the tools themselves, are facts, and students will learn how to use the tools to find correct answers instead of becoming independent constructors of knowledge. This represents a conflict between active learning techniques and a view of knowledge as a static concept. While there is a recognition that students learn better through active learning techniques, the knowledge being learned is still viewed as factual and unchanging, further reinforcing the masculine nature of STEM education.

Finally, a review of the syllabi for gendered language and discourses involves an exploration for the discourse of STEM higher education as creating a chilly climate, one that is difficult, competitive, and lacks support. The syllabi explored in this study promoted a view of the classroom as academically difficult, with high standards that were not flexible. For example, “please be reminded that all writing you do in this course will be expected to meet a **certain** standard of competency and quality” (Lower level geology). The language used promotes the idea that the high standards of the course were inflexible and difficult, and exceptions would not be made if students could not meet expectations. That difficulty is reinforced through the use of comprehensive exams, “Each exam is semi-comprehensive. And the final exam is fully comprehensive. This means that tests may contain information from throughout the semester” (Lower level geology). Also reinforcing the difficulty of the courses was the treatment of prerequisites as skills or topics that the instructor would not have time to cover in the course.

Good algebra and trig skills are essential if you expect to be successful in this course. In addition, you are expected to have sufficiently mastered the material in Calculus I to be able to use it when needed. We will not have time in this class to devote to prerequisite materials (Lower level math).

Instead of only listing prerequisite courses, these syllabi included prerequisite knowledge and skills, creating an even more intimidating view of the course. That language implied that not only would students be held to difficult high standards, but also that there was also a base of knowledge that was required to be successful in the course. While it is not unrealistic to include prerequisites in a syllabus, the language used to discuss the prerequisites indicated that students who had not learned or did not remember that knowledge would be unsuccessful because there was not support within the course or from the instructor. The language used in this corpus of syllabi created an impression of extremely difficult courses, which contributes to the chilly climate in STEM courses, and would be prohibitive for those not confident in those areas, such as women and minorities.

Additionally, a chilly climate is reinforced with a focus on the individual instead of the group and is a characteristic of a masculine learning environment (Mayberry & Rose, 1999).

If you have particular problems with writing, you are encouraged to seek assistance from the Writing Center (Lower level geology).

Although asking questions is very important, it is also important to study on your own. The ability to achieve university degree corresponds to the ability of the student to study and think independently (Upper level chemistry).

The onus is placed on the individual for learning, and there is little discussion about how the group can support and contribute to learning. Not only is group work not encouraged, in some cases, the language is hostile to it. A focus on only individual learning reinforces the masculine way of knowing, as it is traditionally individualistic, while alternate forms of knowledge such as views of women's ways of knowing include a focus on collaboration and the collaborative nature of knowledge construction (Mayberry & Rose, 1999).

Another aspect of the chilly climate is competitiveness, and the STEM syllabi were also framed as competitive courses, exemplified by grading on a curve, "The final grading scale may be curved based on class performance" (Lower level biology). Grading on a curve is one way that the literature has found to be competitive and discouraging to women and minorities (Shapiro & Sax, 2011). Finally, the competitive, difficult chilly climate was reinforced in the syllabi through the use of unfriendly and tough language, "Do not ask me to figure out your grade standing. I'll be glad to show you how to do it yourself, but the homepage includes that explanation already" (Lower level geology). Like this statement, many of the syllabi used language that was unfriendly and reinforced the individualistic, difficult and competitive nature of the STEM classroom. Throughout the syllabi, the chilly climate was reinforced through language use and the selection of assessments and teaching methods.

## **Discussion**

This discourse analysis of STEM syllabi develops a deeper understanding of the STEM syllabus and how it reflects the gendered nature of the STEM education institution. Exploration of the linguistic features used in the syllabus informed and structured this analysis to demonstrate how language used in the syllabus was directive, implied obligation, illuminated the power relationships in the classroom, and used discourses to connect to the larger STEM higher education institution. Those linguistic features shed light on the nature of the STEM syllabus as gendered. Specifically, in response to research questions one and two, in contrast to prior research, this corpus of STEM syllabi demonstrated a more clear distribution of power, as illuminated by the use of "I" and "you" more frequently than "we" and "our," although those collective pronouns were still present. Power clearly resides with the instructor in this corpus, and the onus is on the student to meet the expectations set by the instructor. The use of stance largely reinforces power differential between instructor and student, with a reliance on obligatory statements for students that delineated between what the student will be expected to do and what the instructor will do, as Afros and Schryer (2009) found in their exploration of the genre of the syllabus. In addition, the predominant discourses in the syllabi are those of college teacher, college student roles, and the specific STEM discipline. This also aligns with prior research and reinforces the goal of the syllabi as a document that indoctrinates students into the respective field as STEM professionals (Afros & Schryer, 2009).

In response to research question three, gender is not explicitly referenced within this corpus but the masculine or male-biased views of knowledge, learning and teaching that are seen in the STEM education institution are reinforced in the syllabus. Throughout the syllabi, knowledge is represented as static and unchanging, with some nods to collaborative and active learning to encourage students to acquire course content. Language used in the syllabi

reinforces the unfriendly and difficult nature of STEM courses, and STEM teaching is framed as the instructor's role to deposit static knowledge into students. In those ways, the syllabi replicate the gendered STEM education institution and are gendered to the disadvantage of women.

### Limitations

The largest limitation of this study was the small sample size and limited location. Additional research should focus on a larger sample and explore syllabi from a wider variety of institutions. Additionally, the gender of the instructor was not identified in the analysis. That represents an additional line of inquiry that may differentiate the findings from this study.

### Implications

Although the corpus of syllabi explored was small, the findings from this exploration support the view of STEM courses as chilly. This suggests that there is an opportunity for STEM courses to reduce the perception of courses as difficult and unfriendly through language use in the syllabi, and also as a guide for how to use less competitive teaching methods and grading profiles that could improve the experience of female students. Linguistically, the use of language is powerful in this exploration as framing courses as difficult and the environment as individualistic and competitive. This could be improved through the use of language that welcomes students to see the instructor with questions instead of discouraging them, providing opportunities to learn prerequisite knowledge instead of statements that imply that the course will be impossible without that knowledge, and other opportunities for support within the STEM institution instead of recourse that seemed punitive or remedial, such as Living/Learning communities. Additional research on a larger corpus of syllabi would reinforce those findings, and it would be interesting to follow up with interviews with STEM students about specific syllabi content to see how students perceived the statements made. These would reinforce if these linguistic tools and discourses discussed in this study were perceived to reinforce the chilly climate and masculine nature of the STEM higher education institution. Finally, syllabi, as institutional texts, reinforce the values of the STEM institution (Biber, 2006a). As a part of the male-biased STEM education institution, the syllabi explored in this study also promoted a gendered view of language and learning. This suggests that changes to the gendered nature of STEM education need to begin with institutional changes that will be reflected in the syllabi. Changes to the syllabi are contingent upon the institutional environment, and true transformation requires institutional changes.

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