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PARENTAL PRESSURE AND PASSION: COMPETING MOTIVATIONS FOR CHOOSING STEM AND NON-STEM MAJORS AMONG WOMEN WHO DOUBLE-MAJOR IN BOTH

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Whether the college major serves as a signal of knowledge or a source of it, the choice of one's major is a function of students' beliefs about benefits they expect will accrue to them as a result of this choice. Prior research assumes that students only have one shot at this choice; that is, they choose one major and it is expected to be both externally rewarding and personally fulfilling. This paper utilizes original quantitative and qualitative data about double majors in order to uncover the ways double majoring enables women to negotiate tensions between parental/societal pressures to choose high-prestige/pay science, technology, engineering, and math (STEM) majors and their own affinities towards lower-status non-STEM fields.

KEY WORDS: *STEM disciplines, college majors, gender socialization, double majors*

1. INTRODUCTION

Women have surpassed men in their attainment of both bachelors and master's degrees (U.S. Census 2016) and have achieved parity with them in the successful pursuit of professional degrees, such as law and medicine (National Center for Education Statistics, 2009a). Nevertheless, one of the paradoxes facing contemporary gender researchers is why, in spite of dramatic shifts in women's achievements in other areas in higher education, are women still less likely to choose majors in science, technology, engineering, and math (STEM) fields than their male counterparts (Beede et al., 2011). These differences seem problematic because college major choices have important implications for the post-baccalaureate labor market: science and technology fields reap higher extrinsic rewards than fields (e.g., arts, humanities) that women tend to concentrate [in Charles and Bradley (2002) and Hearn and Olzak (1981)].

Scholars have come to understand the disparity as a function of the long-term impact of gendered social control and socialization, phenomena that shape men's and women's occupational identities, academic orientations, and labor market expectations in divergent ways (Cherney and Campbell, 2011; Correll, 2004; Simon et al., 2017). However, the gap in male and female segregation in STEM majors has been shrinking over time as women have begun choosing to major in STEM fields as a result of parental expectations (David et al., 2003; Mastekaasa and Smeby, 2008) and higher levels of exposure to and success in the sciences prior to college (Williams and Ceci, 2012; Xie and Shauman, 2003). This leads to an important question: if gendered patterns of socialization continue to pull women away from STEM fields while parental demands, supported by their daughters' competence in science, are increasingly pushing women toward STEM disciplines, how do women manage these discordant pressures and bridge what Snow (1960) famously referred to as the "two cultures?"*

Much of the research on college-major choice is based on the suspicion that students are, first-and-foremost, making decisions about their futures (Beggs et al., 2008; Morgan et al., 2013; Stinebricker and Stinebricker, 2011). Whether the major serves as a signal of knowledge or a source of it, the choice of one's major is considered a function of students' beliefs about future benefits they expect will accrue to them as a result of this choice (Berger, 1988; Montmarquette et al., 2002). It is also clear that students—and women in particular—want their careers to matter, to themselves and ultimately to others (Eccles, 2007; Su et al., 2009). As a result, they consider majors that they can be successful in, that are interesting to them—a characteristic not always associated with a major's earning power—and that enable them to meet other important life goals, such as being able to balance family and career (Frome et al., 2006; Malgwi et al., 2005)

The research which precedes this paper assumes that students only have one shot at this choice; that is, they choose *one* major and it is expected to be both financially rewarding *and* personally fulfilling, at least in the short term (e.g., Barth et al., 2015; Leppel et al., 2001). According to Del Rossi and Hersch (2008), nearly 25% of college graduates have at least two undergraduate majors. We believe the assumption that all students choose either a STEM or a non-STEM major obscures the choices and meaning-making processes of some women as they negotiate the double burden of modern femininity where they must increasingly reconcile traditional gender socialization (be expressive, humanistic, caring, etc.) with modern expectations that women will be or should be financially independent, rational, and professionally successful (England, 2010).

This paper utilizes quantitative and qualitative data from double majors in order to uncover how double majoring enables women to negotiate tensions between parental/societal pressures to choose high-prestige/pay STEM majors and their own

*It is worth noting that parents also push their children to major in business as well (Pitt and Tepper, 2012). The impact of that influence is beyond the scope of our study. There is little evidence in the literature that their parents prioritize humanities, social science, or education majors.

affinities towards often lower-status, lower-pay arts, humanities, and social science fields.

2. BACKGROUND

Certainly, one of the most important decisions students will make in college is the selection of their college major. Broadly, a persistent gender gap exists in the decisions to graduate with a degree in science, technology, engineering, and math (STEM).† While incremental, some progress has been made in reducing this gap, as 50,000 more undergraduate women graduate in STEM fields today than did just ten years ago (National Center for Education Statistics, 2009b, 2019). We will briefly discuss two tensions related to these trends: essentialism-based childhood socialization and equality-based adolescent family dynamics. We will then discuss the confluence of these tensions in the process of academic identity negotiation and how they might be ameliorated by the availability of double majors.

2.1 Tension 1: Gendered Socialization and Preferences for Non-STEM Majors

The mechanisms which select and sort students into differing fields are well understood. Women have traditionally been more likely to graduate with arts, education, and humanities degrees while men have been more likely to major in business, engineering, and the physical sciences (Charles and Bradley, 2002; Hearn and Olzak, 1981). While some of this difference can be explained by women's experience of STEM classrooms as toxic, hostile, and competitive environments (Ganley et al., 2017; Heyman et al., 2002; Joseph et al., 2019; Neumann et al., 2016), the consensus among many researchers seems to be that gendered role socialization, which starts in the home, leads women to pursue non-STEM majors (Eccles, 2015; Hadjar and Aeschlimann, 2015; Kim et al., 2018; Simunovic and Babarovic, 2020; Simon et al., 2017). Young women come to believe that their skills are incompatible with STEM careers and that STEM careers are incompatible with their work/job preferences.

Correll's (2001, 2004) work demonstrates that student expectations, based in cultural stereotypes, has a profound effect on how students assess their own abilities and, ultimately, their academic outcomes. She finds that gendered cultural biases inform women's aspirations, preferences, and performance in ways which push women away from STEM fields. Young women describe themselves as more confident and at home in disciplines such as the arts and humanities, even when their level of skills in STEM fields matches and exceeds those of their male counterparts (Mechtenberg, 2009; O'Hara, 1995; Williams and Ceci, 2012).

† The biological sciences are the only exception. This discipline has seen a reversal of the gender gap, with nearly 60% of all bachelor's degrees conferred in the biological science being earned by women. This may be less a reflection of women's deep interest in the biological sciences specifically (e.g., with intention to pursue an MS or PhD in them), than a reflection of women's "altruistic career ambitions" and the associated increase in women's career aspirations in medical fields (Sax et al., 2018).

In addition to shaping girls' beliefs in their competence as scientists, cultural scripts shape other work orientations and preferences that lead to a lack of interest in STEM disciplines. One underlying cultural script—that women are socialized towards activities where they can be nurturing and helpful—is recognized as a major factor in the decisions women make (Charles, 2011; Eccles, 2007). They indicate that they are less concerned about career advancement and compensation than they are with the degree to which jobs (and presumably majors) are interesting and have humanistic or humanitarian outcomes (Beyer and Haller, 2006; Malgwi et al., 2005; Zafar, 2013). While young men are oriented toward object-related fields like chemistry and engineering, young women display an orientation towards people-related fields where they can engage "artistic" and "social" values (Lippa, 2005; Su et al., 2009; Webb et al., 2007).

The kind of socialization that leads to these different orientations is often implicit and takes various, somewhat invisible forms. Eccles (2015) argues that parents' often unconscious stereotypical beliefs and perceptions about their elementary and middle-school aged daughters' performance, activity choices, competence, interests, and expectations for future success lead them to give them different advice, provide them with different toys and sports equipment, and encourage different experiences (e.g., drama camp instead of space camp) than they might if these were sons.[‡] The gender socialization young women receive in their homes is reproduced in school environments (Legewie and DiPrete, 2014; Riegle-Crumb and Humphries, 2012; Shapiro et al., 2015). Morgan et al. (2013) argue that girls and young women are steered away from STEM careers throughout their elementary and secondary school years, so that by the time men and women choose their college majors, many have already formed gender-differentiated plans and pathways.

2.2 Tension 2: Parental Pressures to Choose STEM Majors

While it is the case that parents contribute to the kinds of socialization and resulting gendered values, perceptions, and ability beliefs described above (Bleeker and Jacobs, 2004; McGrath and Repetti, 2000), it is also true that parents encourage high aspirations and high levels of academic achievement in their children. Researchers have long understood the important role parents play in shaping the educational career paths and decisions of their children. Increasingly, researchers have determined that the greatest family impact on the educational choices of students is in the area of expectations (Davis-Kean, 2005; Neuenschwander et al., 2007; Simunovic and Babarovic, 2020). The impact of expectations does not stop at the college gates. It is clear that, even in college, parental values and preferences matter and parents are very much involved in academic decisions students make (David et al., 2003; Leppel et al., 2001; Wolf et al., 2009).

This is especially the case for women. David et al. (2003) find that women are more likely than men to consult with their parents when making academic decisions. This

‡ For a detailed review of the literature on the impact of parents' beliefs on women's motivations and choices in the STEM domain, see Simunovic and Babarovic (2020).

consultation does not necessarily lead to differing outcomes. Mastekaasa and Smeby (2008) offer evidence that there are no significant differences in parental encouragement: college-aged women are as strongly encouraged to pursue STEM fields as men. This is particularly true when those parents are well-educated themselves. Research has found that well-educated parents encourage their daughters, like their sons, to pursue majors in science, engineering, and math (Trusty et al., 2000; Ware et al., 1985). They recognize the higher earnings and status associated with STEM professions and want these outcomes for their children. While parents are engaged in their children's academic lives in a number of ways (Wolf et al., 2009), most of their attempts to influence major choice are focused on getting students to pursue lucrative STEM and business majors.

Buchmann and DiPrete (2006) argue that while families have historically accorded more of these parental resources with regard to education to their sons, this dynamic has changed with the rise of more egalitarian sex-role expectations. Women have turned their long-held advantage in academic performance into superior academic outcomes (e.g., postsecondary graduation rates) as the barriers for utilizing their skills and knowledge have decreased. Increasingly, there is evidence that parents recognize the value of this investment as well, and devote time, money, and other resources into influencing their daughters into instrumentally lucrative career paths in ways that were once reserved only for sons (Lindner et al., 2004; Trusty et al., 2000; Ware et al., 1985). These more equitable investments pay off in higher levels of self-efficacy women express in regards to STEM and greater opportunities, and inclinations, to consider a STEM field.

Encouraging their daughters to major in STEM fields is seen as empowering them by helping them escape the traditional gender norms these same parents are often complicit in instilling in them. Whether this is truly a mechanism of escape from or simply more evidence of gender norming, this trend is generally viewed as a positive one in terms of gender inequality. However, for many women, having her parents urge her to pick a STEM major in her senior year of high school or first couple of years of college may be too little too late. Again, in spite of high school women having higher grades in math and science than men and achieving similar results as men on standardized testing (Hill et al., 2010; Hyde et al., 2008), by the time they are choosing a major, many have lower beliefs in their STEM competence and report less interest in STEM subjects than similarly positioned men (Fredricks and Eccles, 2002; Watt, 2004). These differences are, in part, a response to years of gender socialization prior to their senior year, socialization that their parents played a role in.

2.3 STEM or Non-STEM? Discordant Expectations and Academic Identity Negotiation

In a meta-analysis of nearly 160 North American articles on the role parents play in gender-based socialization, Lytton and Romney (1991) discovered two important trends in the literature.[§] First, the only socialization area (of 19) where they found consistent effects in the literature was "encouragement of sex-typed activities and sex-typed perception"; this is akin to the kind of gendered socialization we describe in "Tension 1." Second, as we have been saying here in "Tension 2," they found no significant differences between boys and girls in the degree to which parents encourage achievement generally, and in STEM specifically. Therefore, while girls are being socialized to prefer sex-type (i.e., girl-ish) activities, they are also being pushed to have the same level of achievement in STEM as boys.

Yet, even as parental expectations for women are beginning to parallel those commonly held for men, when given the choice of a STEM or a non-STEM major, many women still choose the latter. It seems that the pressure to pursue science majors does not undo the clearly gender-shaped inclinations to pursue other ones. In fact, Mastekaasa and Smeby question if "general gender roles may be more important than direct encouragement." (2008, p. 199). Essentially, there is an "equality norm" out there that this process of academic decision-making seems somewhat resistant to (Charles and Bradley, 2002).

Charles and Bradley argue that the widespread cultural persistence of gender-essentialist ideology should not be underestimated when understanding gender segregation in higher education (2009, p. 924). Therefore, we cannot ignore the societal gender system within which women operate and, thus, the influence of internalized gender-essentialist ideologies. England (2010) adds that women face role-identity pressures which are not only unclear, but are distinctly at odds with one another. These pressures are not the result of micro-level interactions and interpersonal expectations, but rather are connected to macro-level forces. England articulates how the diametrically opposed forces which stand at the center of modern gendered expectations for women are internalized and become tensions women have to manage.

2.4 Managing the Tension: Double Majoring in Both STEM and Non-STEM Fields

Research about these kinds of discordant identity pressures in institutional settings suggests that when tensions like these arise, people will work within existing institutional mechanisms in order to create the space necessary for identity to be constructed not as one or the other, but as simultaneously one and the other (Abrams and Hyun, 2009). This study examines a similar dynamic of academic identity negotiation with regard to socialized gender norms and educational expectations.

With double majors, we are able to examine how some women negotiate competing pressures of modern femininity in their academic pursuits by combining two fields that meet both instrumental (prestige and pay) and expressive (passion and preference)

§ While Lytton and Romney's review is now more than 30 years old, the two trends they reported in the early 90's continue to unfold in contemporary examinations of the persistent—and somewhat baffling—gender differences in college major preferences; in the preceding descriptions of these continuing trends, we cite 40 articles about the role parents play that have been written *since* the Lytton and Romney review.

goals. While the option to double major has been available to students for many years, it has become increasingly popular in recent years (Pitt et al., 2019; Zafar, 2011). Researchers estimate that as many as 25% of college students graduate with at least two majors, with that number nearly doubling at some private, liberal arts schools (Del Rossi and Hersch, 2008).

Women and men graduate with double majors at similar levels (Pitt and Tepper, 2012). The most common approach to combining two majors is to choose two majors within the same category (e.g., two liberal arts majors, two STEM majors), likely because of institutional barriers to completing major requirements for different majors (Del Rossi and Hersch, 2016). Combining a STEM major with anything else may be particularly difficult because science lab times often cut across multiple scheduling time blocks, thereby limiting students' abilities to meet the requirements of non-STEM majors (Del Rossi and Hersch, 2016).

Del Rossi and Hersch (2016) discovered the kind of gendering of majors we see in single majors reflected in double majors. Just as women are more likely than men to choose single majors in the liberal arts (arts, humanities, social sciences) and education, they are more likely to combine two liberal arts majors or have an education major as one of the two. Conversely, men are more likely than women to choose a single major in STEM, to combine two STEM majors, and to combine STEM with a business major; they are less likely to combine STEM with a liberal arts field.

Specifically, we focus on female double majors who combine a STEM and non-STEM major in order to understand how double majors enable women to reconcile the tension between gender socialization and parental preference. These two forces operate in discordant ways for many women, with gender socialization pressing them toward liberal arts fields while parental expectations increasingly compel many women into STEM fields for instrumental reasons. This is not meant to imply that women could not possibly be interested in STEM fields without parental pressures to do so. More than twenty percent (22.48%) of women in Del Rossi and Hersch's (2016) analysis chose single STEM majors or combined two STEM majors; women do major in STEM fields because they are passionate about them. But, as we will show—particularly in the qualitative analysis—when women combine a STEM major with a non-STEM one, parental pressures are a principal factor in that decision.

This research seeks to answer three related questions:

1. Most basically, why do these women choose (both) a STEM and a non-STEM major?
2. Do women who double-major in STEM and non-STEM disciplines report having to manage the dual tensions/motivations the literature describes?
3. Does having the opportunity to choose two majors, rather than just one, help satisfy both their preferences and, if they were a factor, their parents' preferences? If it does, in what ways does it do this?

This study uses a mixed methods model, incorporating both quantitative and qualitative research approaches in a single study. This approach offers a more complete understanding of the tensions we are examining. Ultimately, in order to answer the three questions we have posed, we must first determine if there are gendered differences in how men and women double major. Do double majors choose two majors in the same gendered ways—and likely for the same reasons—single majors choose one? We use survey data to answer that question and then more narrowly focus on focus-group data to answer the three main drivers of this project. This approach enables us to obtain different but complementary data.

3. DATA AND METHODOLOGY

3.1 Survey Analysis

The quantitative analysis draws on data from a web-based survey that gathered information from 1,084 undergraduate double-majors at nine colleges and universities: two large comprehensive public universities, three large comprehensive private universities, two medium-sized private universities, and two small private liberal arts colleges. The survey solicited demographic data and detailed information about students' academic choices (e.g., influences, aspirations, courses taken). The survey targeted students who were entering their 7th semester of college at each of the participating institutions. Late career students were chosen because most students at this stage are done choosing the majors they will graduate with.

Students answered basic questions about each of their majors: the name of the major, when they declared it (this enabled us to determine which was the "first" major declared), degree of satisfaction with the major (not at all, somewhat, very), and whose advice they sought when choosing the major. Pitt et al. (2019) refer to students who couple majors from the same major cluster (e.g., two physical science majors, two humanities majors) as *hyperspecialists*, while students who couple majors from different clusters (e.g., physical science and humanities) are referred to as *hypospecialists;* they refer to single majors as, simply, specialists. We will use this language to refer to the double majors in this analysis. Students who combine two STEM or two non-STEM majors will be referred to as hyperspecialists and students who combine a STEM and a non-STEM major—the focus of this analysis—will be referred to as hypospecialists.

We also asked, "why did you choose the major." Given 15 prompts, students could choose instrumental reasons (e.g., graduates in this major make a lot of money), social reasons (e.g., my parents strongly urged me to declare this major), and expressive reasons (e.g., this major best represents who I really am).

We reduced all of our variables to binary (0,1) variables. STEM majors only included agriculture, biological and life sciences, engineering, and physical sciences (including math and computer science).[¶] Non-STEM majors included all others, including

¶Some majors (environmental studies, geography, neuroscience) are interdisciplinary in nature, often with faculties with either social science training or natural science training. Based on the constellation of faculty teaching these disciplines at the schools where our respondents majored in them and the students' descriptions of the majors, we treat environmental studies and geography as non-STEM and neuroscience as STEM.

social science majors (e.g., psychology). Selected variable descriptions, ranges, and means (all, men, women) are provided in Table 1. While we only occasionally use them in our analysis, we provide means that show how strong a group of students double majors are: 62% have a GPA of 3.5 or higher, 63% have taken a Calculus AP class, 59% have taken an AP class in either biology, chemistry, or physics, and 67% of them have two parents with at least a bachelors' degrees. The students at the heart of this analysis, the STEM/non-STEM hypospecialists, are nearly identical to STEM hyperspecialists in these characteristics. Compared to non-STEM hyperspecialists, they have the same rates of high GPAs (62%), but are more likely to have taken AP calculus (81%), are more likely to have had other AP science courses (80%), and are more likely to have parents with bachelor's degrees (74%); there are no gender differences in any of these four characteristics among hypospecialists.[**]

3.2 Focus Groups Analysis

In addition to surveying students, we conducted focus groups with subsets of them at each of the nine campuses.[††] The mixed-gender focus groups—ranging from 8 to 12 students—only included students who were double-majoring; 52 of these 90 respondents were women. This paper focuses on the eighteen women who coupled a double major in a physical science, life science, engineering, or mathematics (STEM) major with a non-STEM major. Of the remaining 34 women who participated in the focus groups, none had a STEM major in their combination. Table 2 lists our eighteen respondents' races, STEM and non-STEM majors, parents' levels of education, and if they had a parent who worked in a STEM-related field.

Focus-group meetings lasted about 90 minutes each and took place within a private classroom. Each was tape recorded and transcribed. The names in this paper are pseudonymous names chosen by the students. Students were asked a range of questions aimed at understanding why students chose to double major and how they experienced having two majors. The questions included, but were not limited to, the following:

- Why did you choose your majors? Which did you choose first?
- To what degree do you feel that your majors go together? Do any of you have specific examples of ways you have integrated the two majors?
- How do people that matter to you respond when you tell them you have your combination of majors?
- What effect do you believe being a double-major will have when future employers or graduate and professional school admissions committees discover your status?

** There are no differences between men and women who are STEM hyperspecialists, either. The only difference between men and women among non-STEM hyperspecialists is the percentage who have taken AP courses in biology, chemistry, or physics; more men (55%) than women (46%) have.

†† Survey respondents were invited to participate in the interviews and are, therefore, a self-selected group of respondents. Bias analyses revealed no discernible differences (e.g., race, majors, etc.) between those students who were a part of the focus groups and those that were not.

TABLE 1: Selected descriptive statistics

Variable	Description	Range	Mean	Men	Women
Gender	Respondent is female	0 (no)–1 (yes)	59.2	—	—
STEM major	Respondent has a STEM major in their combination	0 (no)–1 (yes)	30.9	40.8	24.01***
Hyperspecialist STEM	Respondent couples two STEM majors	0 (no)–1 (yes)	8.9	15.3	4.39***
Hyperspecialist NON-STEM	Respondent couples two non-STEM majors	0 (no)–1 (yes)	69.1	59.2	75.98***
Hypospecialist	Respondent couples a STEM and non-STEM major	0 (no)–1 (yes)	22.0	25.5	19.62*
Major 1 satisfaction	Respondent is “very satisfied” with their first declared major	0 (no)–1 (yes)	30.7	34.9	27.78*
Major 2 satisfaction	Respondent is “very satisfied” with their second declared major	0 (no)–1 (yes)	31.6	35.3	29.35*
Prestige matters	Factor in Choice: It is considered a prestigious major	0 (no)–1 (yes)	47.3	56.9	40.65***
Money matters	Factor in Choice: Graduates make a lot of money	0 (no)–1 (yes)	29.5	42.4	21.03***
Identity matters	Factor in Choice: It best represents who I really am	0 (no)–1 (yes)	77.9	70.8	82.57***
Interest matters	Factor in Choice: I find the subject interesting	0 (no)–1 (yes)	97.8	96.4	98.9*
Helping matters	Factor in Choice: To make an important contribution to the world	0 (no)–1 (yes)	66.7	58.5	71.89***
Professors matter	Factor in Choice: I know and like professors in the department	0 (no)–1 (yes)	53.3	48.5	56.82**
Peers matter	Factor in Choice: Several of my friends are majoring in it	0 (no)–1 (yes)	20.2	23.9	17.42*
Parents matter	Factor in Choice: My parents strongly urged me to declare the major	0 (no)–1 (yes)	15.4	13.7	16.8
High GPA	Respondent’s GPA is 3.5 or higher	0 (no)–1 (yes)	62.3	61.2	63.4
Calculus AP	Respondent has taken a Calculus AP course	0 (no)–1 (yes)	62.8	69.5	58.7***
Science AP	Respondent has taken a Chemistry, Biology, or Physics AP course	0 (no)–1 (yes)	58.9	66.7	53.9***
Not first generation	Respondents parents both have a BA degree or higher	0 (no)–1 (yes)	66.9	70.2	64.8

Asterisks indicate significant differences between women and men on each variable.
*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; $n = 1084$.

TABLE 2: Participants

Pseudonym	Race	STEM Major	Non-STEM Major	Mother's Education	Father's Education	STEM Parent
Anna	Asian	Engineering	Economics	MA or equivalent	PhD, MD, or JD	No
April	White	Chemistry	Psychology	PhD, MD, or JD	PhD, MD, or JD	Yes
Caroline	White	Math	French	MA or equivalent	PhD, MD, or JD	No
Emily	Other	Biology	Environmental Studies	HS or GED	Student Unsure	No
Iris	Asian	Chemistry	Economics	HS or GED	PhD, MD, or JD	Yes
Isabel	White	Biology	Psychology	PhD, MD, or JD	MA or equivalent	Yes
Laura	White	Math	Spanish	MA or equivalent	Student Unsure	No
Lauren	White	Neuroscience	Psychology	MA or equivalent	PhD, MD, or JD	No
Leigh	White	Math	Sociology	MA or equivalent	MA or equivalent	No
Marie	White	Math	Spanish	PhD, MD, or JD	MA or equivalent	Yes
Roni	White	Chemistry	Creative Writing	MA or equivalent	MA or equivalent	No
Sara	Asian	Biology	Art History	MA or equivalent	PhD, MD, or JD	Yes
Sherri	Latina	Physics	Piano	BA	Student Unsure	Yes
Stella	Asian	Chemistry	Anthropology	HS or GED	BA	No
Susie	White	Biology	Religion	MA or equivalent	Student Unsure	No
Tina	Asian	Math	Economics	MA or equivalent	MA or equivalent	No
Veronica	Latina	Biology	Religion	BA	HS or GED	No
Zadie	Asian	Biology	Writing	Student Unsure	Student Unsure	Yes

The focus group questions generated subtler and more textured information about students' experiences within their majors than was provided by the survey instrument. We analyzed the transcripts of the focus groups using the qualitative data analysis software ATLAS.ti. Using a version of Glaser and Strauss' (1967) constant comparative method, we coded transcripts into broad categories based on the questions we posed to the students. Our team subsequently coded the transcripts more narrowly based on answers to those questions, particularly discussions about major choices; evaluations of those choices by peers and parents; and if/how they are able to integrate the majors into a coherent identity. Intercoder reliability (83%) of these codes was determined by having a second reader code references to three main ideas (parents, balance, future) for six randomly selected respondents. Comparisons were then made across various categories (e.g., race, parental STEM careers, type of STEM major) specific to the women themselves to assess patterns among their responses. We carefully examined the possibility of any negative cases (e.g., where parents were never a consideration) to determine if any exceptions to our general themes were significant enough that they needed to be addressed in our final analysis. The survey data also provided additional checks on the validity of our themes. For example, knowing that all eighteen women agreed that their non-STEM major "represented who I am" while only three of them described their STEM majors the same way confirmed the patterns we saw in our transcripts. Alternately, only one woman agreed that the choice of her non-STEM major (economics, her university's proxy for "business") was influenced by her parents; fifteen women described their STEM majors this way. Finally, we reviewed all of the quotes to find those that most clearly represented the themes that arose from our discussions of the data.

3.3. Researchers' Positioning and Subjectivity

As a research team composed of both men and women, representatives of three racialized groups (Black, White, Chinese National), and well-educated social scientists (one of us has a PhD and the others have MA degrees), we recognize that our identities and experiences had some influence on our analysis of the data provided to us in this study. Likewise, it is important to acknowledge our positions as STEM researchers and social scientists who are particularly concerned with the inequities faced by marginalized groups in STEM. We understand STEM spaces as raced, gendered, and classed and that students and professionals in STEM are impacted by these axes of marginalization and their intersections. Our research infuses two paradigms. It is critical because it centers the narratives of marginalized individuals majoring in STEM (DeCuir-Gunby and Walker-DeVose, 2013). It is also interpretivist because this work aims to understand the participants' subjective experiences through their own words (Guba and Lincoln, 1989). At every stage of this analysis, we endeavored to maintain a position of phenomenological epoché, that is, an analytical stance that "bracketed" or suspended some of the biases we might have brought to this project as researchers who would like to see STEM be more inclusive of women and other underrepresented groups.

3.4. Protection of Vulnerable Populations

Recognizing that women and people racialized as non-White are rare in STEM disciplines and even more rare among those who graduate with a STEM and non-STEM major, we have taken great pains to protect our respondents' identities by anonymizing the quantitative data, using pseudonyms for these women, and making subtle changes to the names of majors that are unique to the colleges these women attend.

4. ANALYSIS AND RESULTS—SURVEY DATA

Do men and women double-major in STEM disciplines (i.e., agriculture, engineering, life sciences, and physical sciences) at different levels? Yes. The choice of a double-major combination is gendered in the way we have been suggesting. Men (40%) are more likely to include a STEM major in their double-major pair than women (25%).[‡‡] While there are no differences between men and women in the degree to which they choose to hypospecialize, men (16%) are more likely than women (5%) to combine two STEM majors and women (75%) are more likely than men (59%) to combine two non-STEM majors. When men and women hypospecialize, there are no differences in the ordering; both genders (60%) pick the STEM major first. As both men and women explained in the focus group interviews, this is often more a function of the structured curriculum of STEM majors than an indication of preference.

Does gender shape decisions around what the non-STEM major is when students hypospecialize? Yes. The other broad major clusters we analyze are arts, area and ethnic studies, business and economics,[§§] communications and journalism, education, health professions (e.g., nursing), humanities, languages, and social sciences. Men (45%) are more likely than women (17%) to also major in business and economics. Women (26%) are more likely than men (14%) to also major in the social sciences. Women (19%) are also more likely than men (9%) to choose a language as their second major. Of course, the STEM majors they choose are gendered as well. Women (50%) are more likely than men (23%) to choose a biological science as their STEM major when hypospecializing. Men (46%) are more likely than women (20%) to choose engineering as their STEM major.

Does gender shape the reasons students choose their majors? Yes. While there were no areas that either men or women did not check as reasons for choosing their major, there were areas where the degree to which that factor mattered for women compared to men was significantly different. Men are more likely than women to say the major's prestige (M: 57%, W: 41%) and reputation for post-baccalaureate earnings (M: 42%, W: 21%) were the reasons they chose their first or second major. Women were more likely than men to say their major choice best represents who they really are (W: 83%, M:

‡‡ All of the differences listed here are statistically significant ($p < 0.05$).

§§ We combine economics with business instead of social sciences because on six of our nine campuses, in the absence of a business major, economics often served as a proxy business major for students. The three economics majors in the focus group analysis are all on those campuses.

71%), that previous life experiences led to the choice (W: 74%, M: 55%), and the major enables them to make an important contribution to the world (W: 72%, M: 58%). Again, women are not absolutely different from men. They choose majors for instrumental reasons (e.g., prestige, money earning potential) as well. Likewise, men choose majors for expressive reasons (e.g., the major feels like them). The dynamic that matters is the gap between men and women: a 17–18 point gap in instrumental motivations and a 9–15 point gap in expressive motivations.

Even social influences differ for men and women. Women are more likely to credit professors they know and like for their choice (W: 57%, M: 49%). This finding echoes research on the role of college major departments in the reproduction of sexual inequality: women tend to choose majors with lower postbaccalaureate benefits, in part, because they—more than men—care about the degree of support they have received from faculty in those disciplines (Hearn and Olzak, 1981).

Few students give their parents much credit for the choice of major. About 15% of all double majors say their parents strongly urged them to declare the major.[¶¶] Thirty-one percent (31%) of these students chose STEM, 29% chose business and economics, and the remaining 40% chose other disciplines (half of which were psychology or a foreign language[***]). There are no significant differences between the genders when we look at all double majors together. But, when we compare students who have a STEM/non-STEM combination (hypospecialists) to all of the other students, we begin to see that parents play a particular role with particular students' choices.

Nearly a quarter (24%) of women who hypospecialize say their parents urged them to declare one or both of the majors. Only 15% of hyperspecializing women say this. Men have similar pressures: 20% of hypospecialists say their parents pushed them to choose their major(s). Parents do not seem to be a factor for the STEM/STEM and non-STEM/non-STEM hyperspecialists; similar analyses yield insignificant relationships. This suggests that there is value in focusing in on the role of parents in shaping the decision to pair a STEM and non-STEM major together.

When we look at the ordering of the declaration—STEM field first or STEM field second—we again discover intersections between parents' roles and students' decisions. Twenty-one percent of these students say their parents strongly urged them to pick the STEM major when it was the first major; women did not differ from men. The differences appear when we look at the choice of a STEM major as the "second" major. Seventeen percent of women say their parents urged them to choose that major and only 4% of men say the same.

The final quantitative analysis we engaged in was to examine students' satisfaction with their major. We find that 83% of hyperspecialists who choose two STEM majors say they are very satisfied with their STEM majors and 86% of those who choose two

¶¶In a separate analysis of single majors, we found that only 6% of them say their parents were a factor in their major choice. Thirty five percent are STEM majors, 27% are business majors, and the remaining 38% are equally split between the arts, humanities, and social sciences.

***Whether at the urging of parents or not, foreign languages were more likely added as the second declared major. They were also added later (e.g., in the sixth of eight semesters) than other second majors. According to Pitt and Tepper (2012), this is largely a function of choosing the major in conjunction with a junior year study-abroad experience.

non-STEM majors say they are very satisfied with their non-STEM majors. In both cases, women are more likely than men to be very satisfied with their majors.[†††]

In regard to preparation, women who combine a STEM and non-STEM major have similar GPAs, similar experience with Calculus and other STEM Advanced Placement courses, and similarly well-educated parents as the women who combine two STEM majors; both are capable of succeeding as scientists. The difference appears when we look at satisfaction. Ninety-six percent of women STEM hyperspecialists say they are very satisfied with their STEM major(s). Less than half (48%) of women hypospecialists say the same. Only 25% of women whose parents urged them to pick a STEM major say they are very satisfied with it; this rises to 53% for those women who do not credit their parents with their choice to major in STEM.

Altogether, these analyses reveal for double majors what other researchers (Charles and Bradley, 2002; Hearn and Olzak, 1981; Simon et al., 2017) have shown us in their analyses of single majors: gender shapes men's and women's choices of college major. Like the single-majors research, we show that women choose STEM disciplines less often than men, women choose different STEM and non-STEM disciplines than men, and women choose their majors for different reasons than men. This last revelation—that men are more likely to claim instrumental motivations and women are more likely to claim expressive ones—maps onto our discussion of Tension 1 (gendered socialization and preferences). Do we believe that asking a woman why these differences exist would yield the answer "because I'm a woman"? No, virtually no surveys or interviews on this topic have yielded that response from students. But can we be certain, based on these differences, differences that reveal themselves again and again in most research on college majors, that gender scripts, gender role ideation, and gender identity are likely contributors to these differences? Absolutely.

The analysis also revealed something that is unique to double majors, the possibility of graduating with both a STEM credential and a non-STEM credential. While instrumental (prestige) and expressive (passions) influences also drive these student's decisions, the role of parents becomes clearer. This factor too can be gendered: women, more than men, say they chose their second major in STEM because their parents urged them to. The pressure to choose a major revealed itself in the degree of satisfaction with the major. Students with majors their parents urged them to pursue were less satisfied in those majors. In particular, few women whose parents urged them to pick a STEM major said they were very satisfied with the major. In addition, women majoring in STEM at the urging of their parents were less likely to say their major felt like them (25%) and interested them (56%) than women whose parents were not listed as a factor (41% and 89%). In the next section, we will use the focus group data to further unpack how these women's choices reflect parental pressures and their own passions and preference.

††† Women (96%) are more likely to say they are satisfied with their STEM majors than the men (78%). Similarly, women (89%) are more likely to say they are satisfied with their non-STEM majors than the men (80%).

5. ANALYSIS AND RESULTS—FOCUS GROUP DATA

Our goal in this project was to understand how women use double majoring in order to reconcile the tensions between instrumental and expressive motivations for those decisions. Our analysis of focus group data resulted in two major themes which we develop in the pages that follow.

These two themes reflect the main conceit of this paper, that women have to straddle two tensions when choosing a major, that is, choosing training that is expected to be both financially rewarding *and* personally fulfilling. Double majoring allows them to have both. It is a common belief that double-majors, particularly those who choose high prestige and low prestige fields, are choosing a "practical" major and a "fun" one. We discover that for these women, the choice of a STEM major is driven less by their personal evaluation of these majors as practical than by their parents' evaluation of the major. First, we will examine the pressures women receive from their parents to make wholly instrumental decisions about their majors; double majoring makes the STEM major—often their *parent's choice*—agreeable to them. Then we will discuss how double majoring enables these women to pursue their passions by coupling a non-STEM major—their *own choice*—with the STEM major that they were driven to pursue for less-expressive reasons. Finally, we will show how the students defend the choice to declare a second major rather than simply single-majoring in STEM and taking non-STEM electives, a defense some say they had to make in order to convince parents to support the cost of the extra credits two disparate majors required.

5.1 Why Choose a STEM Major? Prestige and Parental Pressure

One of the areas where the tension between student passion and parental preferences is clearest is in the choice of high- and low-prestige/pay fields. The pressure to complete high-prestige STEM majors is sometimes at odds with students' affinities toward relatively low-prestige non-STEM subjects. Much of this pressure surrounding occupational prestige comes from their family of origin. Marie (math and Spanish) says that she always planned to take math classes, but her mother was pressuring her to do more than that: "My mom kept pushing me to take math classes and trying to get me to become an actuary. I completely rebelled and picked Spanish as my major first. I went back to math as soon as she stopped pestering me." Similarly, Roni (chemistry and creative writing), who described science as something that "always made sense," focused her attention on the non-STEM major until "[her] parents were like, 'well, you need a job when you graduate, so maybe you should think about not just majoring in creative writing."

Parents with high levels of education are more likely to encourage their children to pursue what they perceive as high status, financially lucrative career paths (Buchmann and DiPrete, 2006). These preferences which have historically been bestowed on their sons are now being extended to their daughters in ways that feel, to the women we interviewed, like pressure to pursue STEM majors for their instrumental value. For example, Iris (chemistry and economics) compared how her parents, particularly her biochemist father, evaluate her major relative to her sister's:

> *I was originally an econ major and then I switched into chemistry too. My parents love the fact that I'm a chemistry major. Because my sister, she was a psychology major, and they never wanted her to be a psychology major. We're that Asian family where we're like 'science or die!' So, I guess adding chemistry edged me up in the hierarchy of family things.*

It became clear in our focus groups that women with at least one STEM major tended to have parents who have advanced degrees in STEM areas or are working within science, technology, or engineering. For example, Stella (chemistry and anthropology) says her "very technical science" family considers "the humanities and everything non-science is fluff, not relevant, not marketable. They believe that if you major in anything that's not science, you're not going to be able to find a job."

Sara, who is double majoring in art history and biology, described feeling pressure, particularly from her father, to *not* major in art history. She described her father this way: "My dad has one PhD, two masters, and three bachelors. He is really good at a lot of things. I think when he was in undergrad, he studied mechanical engineering and chemistry and economics or something so he is just generally good at everything." When asked how her father talks about her major with his peers and whether he mentions both majors and in what order, Sara explains:

> *I guess part of the reason he doesn't mention the art history part at all is when I came to school he wanted me to double major in chemistry and economics, which is kind of like what he did. And I didn't like chemistry, and I absolutely hated economics. So I think that part of the reason he doesn't say it is because he's disappointed that I didn't turn out exactly like him.*

Emily, who is majoring in biology and environmental studies, shared a similar sentiment when she responded, "I have a lot of older cousins and my parents are all doctors and lawyers and so there's a lot of pressure to do something kind of prestigious. So I always thought about science, like hard sciences." In this statement, she marks her STEM major as prestigious, and attributes that prestige to the external source of living up to familial expectations—expectations which are based on the value of having high human capital. Lauren (neuroscience and psychology) also acknowledged parental preferences for one major over the other. She said "I always say I'm neuro first...it sounds more impressive apparently. My mother [a clinical psychologist] may not even know that I'm double majoring because she just sees neuro as a more 'sciency' psychology major that can lead to a job immediately. That's how she describes me around other people." Lauren describes her parents as ambivalent, at best, about her second major in psychology.

These statements by Emily, Sara, and Lauren suggest that some of their understanding of the value of these majors—and concomitant motivation to major in them—comes directly from family members. Emily's parents, like those of some of her peers, not only resent her choice to add a less "strategic" second major, but refuse to even acknowledge the choice: "My mom completely ignores the environmental studies major. She is, like, 'Emily is going to be a biologist. She likes to do research,' which is not true. In fact, next year I'm planning to do AmeriCorps and work with communities and she definitely doesn't see that."

Sometimes family pressures to choose prestigious, high-paying science majors create a tension for those women whose affinities lie in other areas entirely. Stella (chemistry and anthropology) described the decision to choose a major as a difficult one that was, ultimately, ameliorated by the opportunity to graduate with two majors. She pointed to both family and high school dynamics in shaping her seemingly unrelated interests, and eventually her divergent major choices. She says:

> *I've always vacillated between social science and the hard physical sciences. Growing up, I was always interested in history, economics, and psych. I also grew up in a very technical science family so I have that background. Eventually I chose chemistry because my family was leaning towards that side more. But then I was like, 'This is not what I imagined it to be.' I wanted to expand my knowledge more so I chose anthro, specifically because it incorporates everything like history, economics, basically everything in the humanities.*

Stella's description of a decision tied to a desire to follow in family footsteps was echoed almost exclusively by her other STEM/non-STEM majoring peers. Women who were pursuing degrees that did not include STEM fields rarely stated any connection between their chosen fields and those of their parents.

It was clear in the interviews that parental and family prodding often occurred indirectly through modeling. Zadie (biology and creative writing) spent much of her high school years in India volunteering with her physician parents, an experience that fascinated her and left her with a desire to "leave an impact and do medicine. It just kind of seemed natural to be a bio major." But, once she got to college and began to encounter interdisciplinary courses such as "medicine and literature" and "creative writing in the health sciences," she reignited a passion for writing and declared a second major (and ultimately doing an honors thesis) in creative writing. She noted that the decision to even consider—*let alone* extend her time in school because of—a non-STEM major did not please her parents: "My parents really wanted me to graduate in three years and they don't understand why they are paying for creative writing. They're not very supportive at all; to the extent that my grandma who lives in India told my mom that if I spend too much time imagining things that I would develop schizophrenia."

These data show that the women in our study feel the pressure of parental preference, often articulated as a "requirement" to at least consider a primary major with extrinsic, rather than intrinsic, occupational benefits. For many of our respondents, parents and family are actively dismissive of their plans to pursue a non-STEM degree. Nevertheless, all of them do. How do they explain their decision to (also) pursue a major in a non-STEM discipline given these pressures?

5.2 Why Choose a Non-STEM Major? Preferences and Passions

While our respondents point to family pressure as an important factor in choosing the STEM major, it is clear in many descriptions that they regard their non-STEM majors—in Spanish, art history, anthropology—as the major they would have chosen without such pressures. These are the majors they describe using words like “love” and “favorite,” terms virtually absent from women’s descriptions of their STEM fields. They choose the non-STEM major because they are passionate about the subject.

If we just look at the order in which student chose the major or even the one they name first when saying what the majors are, one might assume that the STEM major was the one they were most passionate about; STEM majors were often declared and listed first. In fact, initially, some of the double-majors even described their STEM major as something akin to a central academic identity, often referring to it as their “primary major.” As their accounts of this labeling unfolded, it became clear that this label had a more structural, non-emotional, origin. Laura (math and Spanish), who declared her major in math the first week of her freshman year thought that she was going to go into a career that was math-oriented. She says:

> *[this changed]. . . when I took my first Spanish class in college. It was more focused on cultural studies and history and I had never been exposed to that before. I thought it was so interesting, so I decided to keep taking more classes, and I loved every single one. It’s nice to not just do math proofs all day long. Even though I’m going into a career related to Spanish, because math was my first one, I continued saying it as my primary major.*

Laura was not an exception. Upon further investigation, more than half of our respondents made it clear that this “primary” status was tied more to the structured requirements of the major and the timing of that major’s declaration than any particular passion for the major. When asked if she sees herself as an engineer, engineering and economics major Anna said, “No, but that’s because I know I don’t want to work as an engineer.” But she had to declare the engineering major first because of the structure of the major, rather than some signal of greater interest in it.

Sara (art history and biology) has always known that she wanted a career in the healthcare industry, but seems to find her passion in art:

> *In high school, I took a lot of art classes. I took AP art history and a few studio art classes. I have also been taking Chinese painting and calligraphy classes since I was 10 or so. I really care about art history. There was a semester or two where I considered not being premed and [instead] go and get a PhD in art*

> *history. A lot of times I jokingly refer to my two majors as my real major and my fun major.*

It is clear that her parents see the majors the same way. She says that when they describe what she is doing in college, "they just tell people that I'm going to medical school and that my art is just something I do for fun." Sara's statement about her "real" major and her "fun" major is echoed by many of her STEM/non-STEM double-majoring peers. When we look more closely at what women who combine STEM and non-STEM fields say about their separate majors, it is clear that practicality and prestige matter more in the choice of the STEM major than the non-STEM major. However, when we look at how students' passions factor into these decisions, we find that having the ability to double major allows these women the opportunity to choose majors for both instrumental and expressive reasons. Is it likely that, without the ability to graduate with two majors, they would have ultimately had to choose the one they are least passionate about.

Often, the administrative walls built between colleges (e.g., Engineering, Arts and Sciences) at universities make it difficult for women who have interests in majors outside of any particular college. Caroline (mathematics and French) found that she could not adequately immerse herself in a humanities major while pursuing coursework in her university's separate School of Engineering. While the School of Engineering advisors assured her that it was possible for a student to combine an engineering field with a second area outside the School of Engineering, the scheduling of courses and her difficulties getting courses to count as electives in both schools made her chosen double-major combination unwieldy. She describes her resolution of the challenge this way:

> *I bounced about between schools. I came in as an Arts and Sciences student. Then sophomore year, I switched and did biomedical engineering [in the School of Engineering]. I liked it, but I really love French and did not want to give it up; I did not want to give up the humanities. Even though I like the engineering classes, my professional goals weren't actually to be an engineer, so I transferred back to Arts and Sciences and replaced engineering with math.*

Caroline's statement that she "liked" engineering, but "loved" French was characteristic of the ways women described their non-STEM majors. While they recognized—and valued—the instrumental benefits of the STEM major, it was clear that there were stronger *emotional* ties with their majors in languages, literature, history, and the social sciences.

The emotional tie to the non-STEM major is also reflected in students' satisfaction with the majors. When asked to what degree they are satisfied with their majors, these double majors were more satisfied with the non-STEM major than their STEM major. Leigh (mathematics and sociology) says, "Math has always been something that I was good at and that I enjoyed. But when I came to college, I specifically did not want to be a math major because I'm intending to go to law school. I took a sociology class and just fell in love with it because it is so completely different from math; it is applied to real life and it was fun." Ultimately, Leigh continued to take enough math courses each semester so that she had amassed enough credits to graduate with the double major in sociology and math.

Finally, we found that this dynamic of balanced prestige and passion played out in another revealing way. We asked these women to tell us how likely they are to focus on one major or the other either when talking to others about schoolwork (e.g., friends, parents) or when thinking about their core identities and future plans. While our other respondents with majors in two non-STEM disciplines are slightly more likely to focus on the major they settled on first in every context, these STEM/non-STEM double majors are more likely than the others to compartmentalize their descriptions. They are more likely to describe themselves to parents in terms of their STEM major, but when they think about who they are at their core, in terms of identity, they are significantly more likely to focus on the non-STEM major.

5.3 But Why Two Majors?

While parental pressure and student passions are not always at odds, when they do conflict, the option to double major serves as a mechanism to satisfy both desires simultaneously. Our respondents expressed preference and passion for non-STEM majors despite parental pressure toward high-prestige STEM fields. The subtext of many of these accounts was their belief that parents would not be supportive of a decision to choose the less prestigious "passion" major alone. The women in our study demonstrate that when these desires—for prestige and passion—are at odds, double majoring is a strategy that allows them to also maintain their course of study in a field which matches their passion.

But, again, why double major? If these women felt the need to attain high-prestige training in a STEM major while also pursuing intellectual passions in non-STEM fields, weren't elective courses in the non-STEM fields enough? While the opportunity to take some electives is an option for STEM students, many of them point to the structured nature of their STEM curriculum as a barrier in using those electives to explore courses in their other interests. They complain that the lack of semester-by-semester flexibility in STEM and their own ignorance of options in other fields would have led them away from classes. They argue that the structure of the second major added coherency to what might have otherwise become a hodgepodge of disparate courses that they would have had to squeeze in between the more prerequisite-driven structure of their STEM coursework. Anna explained how being able to major in both engineering and economics enabled her to overcome this problem: "There isn't that much flexibility in taking electives in the engineering curriculum. My personal interest lies in business, so I would have taken [economics courses] anyways, but I feel if I didn't have the second major I would have taken an assortment that might not have been coherent to me."

Another explanation, more often offered in response to the question "how do you explain your choice to your parents and employers" than in response to "how did you choose your major," was that the double major gives them multiple perspectives from which to consider their school work and life more generally. Having scholastic talent in multiple, even seemingly contrasting, disciplines enables them to choose either a STEM or non-STEM major and be successful in either of them. Having the ability to choose both, they say, lets them bring two bodies of knowledge together so they strengthen one another in practical, and ultimately lucrative, ways.

For example, Sara feels that her biology professors and peers see very little connection between that field and art history, but she sees the connection quite clearly:

> *I got a fellowship for summer research to go study Greek sculpture, and so I'm using it to write an honors thesis about the depiction of the changes in Greek sculptural styles and how it's related to the changes in the way that the ancient Greeks studied anatomy and medicine at the same time.*

These women were surprisingly adept at describing how they connect majors as dissimilar to each other as Sara's art history and biology majors. While some spoke broadly about the ways the two majors helped them deepen their skills in one another, it was clear that most of these women were practiced at explaining how the non-STEM major reinforced or supplemented the STEM major. Women believed their non-STEM major made them more creative STEM majors who write better and approach learning more comprehensively. Their accounts rarely went in the other direction, again pointing to the need to explain the value of the major they are more passionate about to people who privilege the more "practical" or "prestigious" field.

They were especially expert at articulating the value of having two majors for post-baccalaureate success. Caroline told us, "I'm going to medical school and I know the combination of the two is interesting to them. I guess math is a science, but it's not a biological or physical science. And French is also something that doesn't come up a lot." From her vantage point, having a French major strengthened her math degree, making her a unique candidate among the larger pool of likely biology, chemistry, and maybe even math single majors. Similarly, Veronica (molecular biology and religion) believes that the combination of a STEM major and a dissimilar non-STEM major makes her more attractive to graduate admissions committees.

> *I'm interviewing for grad school for biomedical research and for some of them [my other major in religion] it's like, 'wow that is really different. It makes you interesting and it says something about you as a person. That is good that you're not just always thinking about one thing. You're thinking outside the box.'*

In a similar vein, the women who were interested in post-baccalaureate employment also spoke of the two majors in terms of their value as a way to make an application more competitive. For example, Sara (art history and biology) described her experience with job interviews this way:

I think it helps because it makes you stand out a lot. The jobs I'm applying for, there's hundreds of biology majors applying for the same job. But I can't imagine there are nearly as many biology and art history majors. Typical job interview questions are 'give me an example when you had to think outside the box.' I have many more examples of thinking outside the box that is different from what everyone else is going to say because I was a double major.

Sara went on to say that it is not just the fact that she is a double major, but the addition of a very different second major, that will help her find a job in a biology employment search. That is not to say that Sara *chose* her non-STEM majors with the intent to use it to marshal more support for their candidacy. Nevertheless, having two majors gave her this opportunity and she has figured out a way to take advantage of that. In these ways, women describe double majoring in signaling terms, that is, having two majors tells potential bosses or graduate programs that they are creative, unique, interesting, or have varied interests while simultaneously reinforcing their diligence and commitment.

These explanations are useful justifications for parents focused on instrumental rather than expressive reasons for picking college majors. The women have crafted narratives that help naysayers—including, they say, themselves at times—understand how their double majors provide them an edge either in terms of marketability or with regard to human capital accumulation. The ability to explain their double-major selections in such articulate ways becomes a strategy to help negotiate divergent parental and student preferences.

6. DISCUSSION

The discordant pressures women face with regard to gender essentialism and gender egalitarianism illuminated throughout the education literature and by England (2010) on a more macro level are very real and present forces in the lives of our respondents, even if they may not recognize—or more likely, know to describe and name—them as such. Our quantitative findings show statistically significant differences between men and women in the frequency in which they double major in STEM disciplines, the likelihood of declaring a STEM major, which specific double-major combinations they choose, and the reasons why they say they choose their majors. Further, gender differences are apparent with regard to the influence of parents, especially for the target group of focus—women who choose both a STEM and a non-STEM major. These women, when urged to choose a STEM major by their parents, are more likely to be unsatisfied with the major.

This mirrors an important finding from our analysis of the narrative of focus group participants: what our respondents want is frequently at odds with what is expected of them. This study shows that double majoring with a combination of STEM and non-STEM majors is a mechanism whereby they can reconcile the tension of their own affinities (influenced to some degree by traditional gender socialization as described by scholars such as Correll, 2001; Charles and Bradley, 2002; Eccles, 2007) and parental and instrumental pressures (as described by scholars such as Lindner et al., 2004; Mastekaasa and Smeby, 2008; Trusty et al., 2000). The analysis presented here suggests a couple of things that are, therefore, important for the field of education in particular and for gender scholars in general.

We discovered that the option to double major allows for women to negotiate their own desires and the desires of their parents. This option allows women the ability to manage the forces of gender socialization and parental expectation which push them to specialize, albeit in competing directions. They could not simply pursue the non-STEM classes as electives. The credential of the major is necessary to provide legitimation to their choice to spend time and money pursuing expressive outcomes. Additionally, the institutional nature of the double major provides a structure which protects against the forces (e.g., advisors, parents) which might otherwise compel them to choose one specialization, and thus one identity, over the other. In this way, we see the utilization of the double major as a tool used by women to resolve discordant identity pressures. Although that was most certainly not the intention of the double major when it was institutionalized, our study shows that it clearly serves that purpose now.

The ability to succeed in both STEM and non-STEM disciplines has been described as one reason women, when forced to choose one major, are more likely than men to choose a non-STEM option (Wang et al., 2013). High verbal ability has long been seen as a strong predictor of both the decision to opt out of STEM initially as well as the decision to switch out of STEM majors at later stages of their academic careers (Frome et al., 2006; George-Jackson, 2011). Wang et al. (2013) show that students with high math skills who also have high verbal skills were less likely to pursue STEM careers than those who have only have the high math skills. They found, unsurprisingly, that the group with both high math and high verbal ability included more female students than male, giving women more choices than men in majors they could succeed in. The ability to double-major in STEM and non-STEM disciplines and take advantage of skills they have in both areas reduces the need to make a choice of one over the other.

This study is an important contribution to sociological research on gender, education, social psychology, and other related fields. Not only do the quantitative data confirm our sense that men and women are making different college-major decisions (even when they double-major) and doing so for different reasons, but they also reveal—through the satisfaction measure—that graduating with a major (STEM or not) does not mean one is enthusiastic about the decision to do so. Likewise, the qualitative focus-group data are rich for analysis in understanding women who double-major in STEM and non-STEM fields and how women see themselves and their futures in relation to those majors. These women—fewer in number and different from those who combine two STEM majors—will graduate with a STEM major, but do not seem enthusiastic about the decision to do so. Together, these data may help us understand women's attrition from STEM careers even as we see an increase in women majoring in STEM and doing well in STEM courses at the high school and college level. If some portion of women choosing STEM majors are doing so with little intention of being scientists, we are only partially solving the "broadening participation in STEM" challenges so many initiatives are being employed to solve. This paper highlights how processes (really, pressures, according to our respondents) aimed at neutralizing gender inequalities cannot fully undo the intractable effects of years of prior equality-dampening gender socialization in homes and schools.

In addition to our important contribution to gender scholarship, our study provides a glimpse into how other identities intersect with gender to influence women's decisions to double major. Women who chose STEM as at least one of their majors tended to have at least one parent with an advanced degree in STEM and/or a parent who currently worked in a STEM field. Also, it is important to point out that over half of our participants had parents who both held an advanced degree and the vast majority of our participants had at least one parent with an advanced degree of some kind. This aligns with research that has found that well-educated parents encourage their children to pursue majors in STEM (Trusty et al., 2000; Ware et al., 1985). We hope that future research is able to provide a focused analysis on how intersecting identities affect the decision to double major in STEM and non-STEM fields.

7. LIMITATIONS AND DIRECTIONS FOR FUTURE RESEARCH

While our quantitative analysis includes our entire sample of 1084 double majors, a limitation of this study is its narrow focus on only 20% of the students we spoke to in our double-majors focus groups. The motivations of the remaining 34 women and 48 men who participated in these conversations are absent from this analysis. As our specific motivation for this study was understanding women who (double)-majored in STEM disciplines, we can't speak to other important possibilities, for example, if men who combine STEM and non-STEM majors have different motivations (e.g., STEM is the passion major) for their actions or if women who do not major in STEM have similar motivations (e.g., business is the prestige major encouraged by parents) for theirs. Examining these possibilities is outside of the scope of this particular analysis, but are certainly questions worth asking.

Another important variable that we only occasionally encountered in student accounts of their decision-making was the larger institutional barriers that forced them to double-major the way they did (e.g., Caroline's decision to switch from biomedical engineering to math in order to double major in French). Lack of semester-by-semester flexibility, required core courses, and complex credit-allowance structures between different colleges within the same university make it difficult for students who choose certain majors to add a second one. Ultimately, any overly structured major—from engineering to music—might create barriers to double-majoring (Pitt and Tepper, 2012) and lead to hard choices our respondents did not have to make. It is likely a function of such barriers that double-majors in engineering and something else were rare in either the larger sample of 1084 students or among our sample of double-majoring focus-group interviewees; notably, our respondent Anna was an exception. Conversely, some institutional innovations, such as the construction of STEM-like interdisciplinary majors (e.g., neuroscience, environmental studies), make it possible for women interested in STEM and non-STEM disciplines to pursue both paths, but only have one major. These phenomena are likely related to what we heard in our focus groups, but their impacts could not be examined as closely as they might deserve. Future scholarship on institutional effects would be useful in clarifying the boundary lines constraining the decision-making processes students "freely" engage in.

Finally, we believe that future researchers would do well to focus on institutional populations as a key variable. While the nine institutions we sampled from included both private and public institutions, the public institutions were flagship universities in their states. Therefore, our sample of students may be biased in having greater access to human, economic, and cultural capital from an early age and throughout their education; we recognize this as a possible limitation for generalizing these findings. Students at other universities with different characteristics than these nine institutions may present a different picture of the choices made to double-major, in which majors, and what the meanings of those choices are to the students.

8. CONCLUSION

The goal of our paper was to understand if and how women used double majoring to reconcile the tensions between instrumental and expressive motivations for their decision to choose their major. We found, through the use of rich, qualitative focus-group data, that the women in our study had to grapple with the pressures of parental and societal expectations, as well as their own competing desires. These stories add nuance to the quantitative data which affirmed what we already know: that many women are inclined to—and ultimately do—chose majors in distinctly gendered ways even when urged to do something different. Ultimately, the narratives of our participants show that some women use double majoring as a way to not have to choose to align with just instrumental pressures or affinal preferences. Instead, we show that double majoring serves as a useful mechanism to reconcile these competing motivations and satisfy both, negotiating an academic identity which combines the two as a way to be both potentially financially rewarded (while appeasing their family) and also personally fulfilled.

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