A Lacanian Ideology Critique of Gender in Mathematics Education

Alexander Stone Moore

Dissertation submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

In

Curriculum and Instruction

Jesse L. M. Wilkins, Ph.D., Chair
Anderson H. Norton, III, Ph.D.
Estrella M. S. Johnson, Ph.D.
Marcus B. Weaver-Hightower, Ph.D.
Alexandre J. S. Pais, Ph.D.

August 28, 2023
Blacksburg, Virginia, USA

Keywords: Lacan, psychoanalysis, gender, mathematics education, ideology critique

Copyright 2023 © Alexander S. Moore, Licensed under CC BY 4.0 International
In this study I employ Lacanian psychoanalysis and ideological criticism to analyze the development of “gender and mathematics” research over the past fifty years. This study is motivated by the original Marxist-Lacanian claim by Valerie Walkerdine in the 1980s that women’s relationship with mathematics must always be considered as fundamentally problematic, and by the complex and often contradictory claims that are made in research artifacts that report on this topic. Many approaches to this topic that focus on “closing the gender gap” or aiming for “gender equity” warrant an ideological critique to situate these motivations within the political realm of mathematics education research. Artifacts analyzed in this study were gleaned from a comprehensive electronic library search of over 600 entries, where 178 were retained as yield. A complete ideological critique was performed on a subset of these. Findings include (1) historical alignment of the ideologies evidenced in the research with the ideological influences of the political situation at the time of publication, including scientism, neoliberalism, evolutionism, and solutionism, (2) the ideology of *interpellationism* which indicates the role of scientific ways of knowing in capitalist political economy, and (3) theoretical foundations of what I call the *feminine-quilted-speech* indicate how at the present moment in the field, we have the opportunity to shift the ideological underpinnings of research on gender and mathematics. The study avows the role of gender as an agent of capitalist accumulation in school mathematics, through a notion I develop called the *masculine-quilted-speech*. 
A Lacanian Ideology Critique of Gender in Mathematics Education

Alexander Stone Moore

GENERAL AUDIENCE ABSTRACT

“Gender and mathematics” is a concern for mathematics education researchers that is old as the field itself, yet it is one that continues to be an active focus for a large swath of researchers. Conundrums abound. Such research includes, for example, neurotic obsessions and phantasies about closing achievement gaps between males and females, whilst other approaches consider the social factors impacting women’s and men’s relationship to mathematics. I wager that one reason for this plurality of approaches (and the incommensurability of their constituent findings and results) is the inability of existing theoretical perspectives for getting to the root of the problem (the point-de-capiton of the discourse). This dissertation offers a political psychoanalytic counter-perspective to prevailing theoretical approaches on the issue of “gender and mathematics” that critiques the ideologies advanced by researchers in the field through their actions of performing and publishing research on this topic. Findings indicate the extent to which ideology structures the actions of researchers, and the role of gender in the capitalist mode of school mathematics.
DEDICATION

For two people who have taught me more about love than anyone else:

For Mom
Who probably believed in me more than I believed in myself.

For Anthony
Whose love is threaded through each sentence of this dissertation. Because the signifier engenders the subject, you are the only reason this text exists.
ACKNOWLEDGEMENTS

I first thank my advisor, Dr. Jay Wilkins. Your guidance and training have led me to be the scholar I am today. Your support is the bedrock on which this dissertation is built.

To my doctoral committee:

Dr. Andy Norton, thank you for your mentorship over the past seven years, without which I would never have come to Virginia Tech.

Dr. Estrella Johnson, thank you for your unwavering support and guidance in helping me find myself. You seem to know exactly what people need to become the best versions of themselves.

Dr. Marcus Weaver-Hightower, you have been an invaluable interlocutor and supporter throughout this dissertation. I am glad we are colleagues. I hope that I would make Michael Apple proud through this dissertation and your influence on it.

Dr. Alexandre Pais, you are one of the most incredible colleagues I could ever imagine to have crossed paths with in life. Your work has unlocked my future for me. Your contribution to this dissertation and my doctoral formation is truly an invaluable gift. I have learned so much from you.

To colleagues who have had an important impact on my doctoral journey:

Drs. Roberto Baldino and Tânia Cabral, you have selflessly supported me as interlocutors, and it is because of your influence that this dissertation came to be.

Drs. Chris Dubbs and David Bowers, you inspire me every single day.

Dr. Agida Manizade, you are responsible for most of my success on this journey into academia. I look forward to many more years of challenging hegemony with you.
Drs. Darryl Corey, Gaston Dembele, and Kristan Morrison of Radford University, and Drs. Jim Garrison, Bonnie Billingsley, Christine Labuski, Bonnie Zare, and Kris Tilley-Lubbs of Virginia Tech—I consider myself truly fortunate to have been your student. It is because of you that I have become a critical scholar with broad theoretical acumen. I can never thank you enough for your influence and for what you have taught me over the years.

My British and American Lacanian cartel members: James Slattery, Cameron More, Sabine Sharp, Richie Riley-Falquez, Raphael Bez-Cryer, Artimis Christinaki, and Saskia Tansy (and Alexandre Pais)—I have spent so much time with you all and learned so much from you over the past two years. It is because of you that I had a chance to become a scholar of Lacan. I hope we can continue to learn together in the future.

Cheryl Vallejo, I have no words for how much our friendship means to me, and there’s no way I could ever recount the amount of support you have given me.

To my family members who have had a special influence on my doctoral journey:

Mom, you are the constant voice in my head. Your love drives and teaches me every day about what is important in life: that we live to lift others up. Your influence is one of the most salient threads evident throughout this dissertation. Watching you navigate the patriarchal space of mathematics education over the years inspires all my work.

The memory of my late uncle, Dr. Robert W. “Bobby” Parris, the Charles B. Thompson Professor of Organ and Historical Keyboards at Mercer University. Your influence has always been and continues to be one of the most salient sources of inspiration and drive that I have. Thank you for showing me the power of bringing joy
and passion into the world through one’s work as a professor. What would Sowerby studies be today without you? Your music was often playing in the background as I wrote this dissertation. Many times, when I am in academic spaces, the words I am speaking seem to somehow be your words. I believe in the importance of being a “true to oneself” scholar because of you.

My grandmother Pete (and the memory of my grandfather Bill), I will never be able to tell you how much of an influence you have had on me over my life; I try to honor you both in every waking minute I have on this Earth. I consider myself to be truly lucky to have been instilled with your values since I was a little kid. Your influence is evident throughout this dissertation and is what grounds all my thinking. Your support and love are invaluable to me and have taught me more than I can ever express.

Finally, and most importantly, my fiancé Anthony: I met you during one of the most contingent and tenuous periods of my life. Many PhD programs lead to divorce. Ours, instead, went the opposite way. For me, that is a strong indication that we have an amazing life ahead together; for that—and for your daily encouragement, support, and love—I can never sufficiently express my gratitude. With almost no exception, this entire text was written after you and I met. I hope you can see the incomprehensible extent to which you are the only reason this dissertation exists, because it has only been through having you in my life that I have been able to write the ideas that are represented in this text. You have put up with a lot during this process. You have bended constantly for me. You have uprooted your life to support me. You have given me so much. I can never thank you enough nor communicate how lucky I am to have met such an amazing man as you. I am so excited to share life with you and enjoy our symptoms.
# Table of Contents

## I  Introduction to an Ideology Critique

1. How This Study is Organized .......................................................... 1
3. Speeches or Discourses? .................................................................. 5
4. The Effects of Ideology ..................................................................... 8
5. Speech, Ideology, and Political Economy ......................................... 11
6. The Masculine-Quilted-Speech and the Signification of Gender ........ 13
7. The Possibility of a Feminine-Quilted-Speech? ............................... 17
8. A Note on Psychoanalytic Language: The Inescapable Trap of the Signifier ...... 20
9. Traversing the Phantasy: An Autoethnographic Interlude .................. 23
10. A Conclusion to an Introduction ..................................................... 28
11. Brief Purpose of the Study .............................................................. 29

## II  The Speech of the Artifacts in Five Epochs

1. Selection of the Artifacts .................................................................. 32
2. Prefatory Note .................................................................................. 34
3. The First Epoch: Biology, Sex-Typing, and Disconcert ....................... 37
   3.1 Summary of The First Epoch ...................................................... 53
4. The Second Epoch: Empirico-Psychology and Complexified Sociology .......... 54
   4.1 Summary of The Second Epoch ................................................. 77
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>The Third Epoch: Critique, Feminism, and Worldview</td>
<td>78</td>
</tr>
<tr>
<td>5.1</td>
<td>Summary of the Third Epoch</td>
<td>85</td>
</tr>
<tr>
<td>6</td>
<td>The Fourth Epoch: Critical Psychology, Critical Theory, Critical Methods</td>
<td>86</td>
</tr>
<tr>
<td>6.1</td>
<td>Summary of the Fourth Epoch</td>
<td>93</td>
</tr>
<tr>
<td>7</td>
<td>The Fifth Epoch: “Doubling Down” on Critique, and the Horizon of Bioscience</td>
<td>94</td>
</tr>
<tr>
<td>7.1</td>
<td>Summary of The Fifth Epoch</td>
<td>109</td>
</tr>
<tr>
<td>8</td>
<td>Overall Summary of the Artifacts’ Speech</td>
<td>110</td>
</tr>
<tr>
<td>9</td>
<td>This Study is Only Thinkable Now: Psychoanalysis as the After-Science</td>
<td>111</td>
</tr>
<tr>
<td>10</td>
<td>Specific Research Question of This Study</td>
<td>115</td>
</tr>
<tr>
<td>III</td>
<td>Theory and Methods for a Lacanian Ideology Critique</td>
<td>117</td>
</tr>
<tr>
<td>1</td>
<td>Theoretical Perspective: Lacanian Psychoanalysis</td>
<td>117</td>
</tr>
<tr>
<td>1.1</td>
<td>Imaginary, Symbolic, Real, Sinthome</td>
<td>119</td>
</tr>
<tr>
<td>1.2</td>
<td>There is No $A\text{ Priori}$ Human-Being</td>
<td>119</td>
</tr>
<tr>
<td>1.3</td>
<td>The Formulas of Sexuation</td>
<td>120</td>
</tr>
<tr>
<td>1.4</td>
<td>Che Vuoi?</td>
<td>121</td>
</tr>
<tr>
<td>2</td>
<td>The Symptom: Psychoanalysis, Ideological Criticism, and Mathematics/Education</td>
<td>121</td>
</tr>
<tr>
<td>3</td>
<td>Hegelian/Speculative Logic</td>
<td>123</td>
</tr>
<tr>
<td>4</td>
<td>Methodology: Ideological Criticism</td>
<td>126</td>
</tr>
<tr>
<td>6</td>
<td>Methods</td>
<td>129</td>
</tr>
</tbody>
</table>
IV The Ideology Critique .......................................................... 133

1 Brief Descriptions of the Grand Ideologies ............................................ 134

1.1 The Scientific Ideology ................................................................. 134

1.2 The Evolutionist Ideology ............................................................. 135

1.3 The Neoliberal Ideology ................................................................. 136

1.4 The Postmodern Ideology ............................................................ 138

2 Historicizing and Ideologically Characterizing the Epochs .................... 139

2.1 The First Epoch ................................................................. 139

2.2 The Second Epoch ................................................................. 142

2.3 The Third Epoch ................................................................. 145

2.4 The Fourth Epoch ................................................................. 148

2.5 The Fifth Epoch ................................................................. 150

3 Benbow & Stanley (1980) (First Epoch) ............................................ 152

4 Fennema & Sherman (1978) (First Epoch) ........................................ 154

5 Becker (1981) (First Epoch) ......................................................... 158

6 Jacobs & Eccles (1985) (First Epoch) ............................................. 160

7 Carr et al. (1999) (First Epoch) ..................................................... 162

8 Lamb (1996) (First Epoch) ......................................................... 165


10 Yee & Eccles (1988) (Second Epoch) ............................................ 169
11 Kimball (1989) (Second Epoch) ................................................................. 175
12 Miller et al. (1994) (Third Epoch) ............................................................. 180
14 Kloosterman et al. (2010) (Third Epoch) ..................................................... 189
16 Hanna (2003) (Fourth Epoch) .................................................................... 195
17 Tiedemann (2000) (Fourth Epoch) .............................................................. 197
18 Q. Li (2004) (Fourth Epoch) ....................................................................... 203
19 Van de gaer et al. (2004) (Fourth Epoch) ...................................................... 204
20 Knowles (2008) (Fifth Epoch) .................................................................... 205
21 Esmonde et al. (2009) (Fifth Epoch) ............................................................. 207
22 Llewellyn (2009) (Fifth Epoch) .................................................................... 210
23 Beasley & Fischer (2012) (Fifth Epoch) ......................................................... 212
24 Bench et al. (2015) (Fifth Epoch) ................................................................. 213
25 Kaldo & Ôun (2020) (Fifth Epoch) ............................................................... 216
26 Leyva (2021) (Fifth Epoch) ......................................................................... 217
27 Solomon et al. (2016) (Fifth Epoch) ............................................................. 219
28 Synthesizing the Ideology Critiques .............................................................. 221

V Conclusion .................................................................................................. 228

1 Primary Critique of the Ideological Artifacts .............................................. 228
<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>(Re)Avowing the Real: A Critique of the Masculine-Quilted-Speech</td>
<td>230</td>
</tr>
<tr>
<td>3</td>
<td>Gender, Mathematics, Capitalist Schooling: Towards a Feminine-Quilted-Speech</td>
<td>232</td>
</tr>
<tr>
<td>4</td>
<td>Failure, the Real, and Universality: The Foundation of the Feminine-Quilted-Speech</td>
<td>237</td>
</tr>
<tr>
<td>5</td>
<td>Implications for Mathematics Education</td>
<td>245</td>
</tr>
<tr>
<td>6</td>
<td>Next Steps: The Mathematical is Sexual</td>
<td>248</td>
</tr>
</tbody>
</table>

References (Excluding Data)                                                                                           252

Appendix I: References for Data                                                                                       264
I Introduction to an Ideology Critique

“Women’s relation to [mathematics] must always be seen as problematic.”

(Walkerdine, 1988, p. 192)

“Gender and mathematics” is a concern for mathematics education researchers that is as old as the field itself, yet it is one that continues to be an active focus for a large swath of researchers. Conundrums abound (e.g., Damerin & Erchick, 2010; Forgasz, 2021). Such research includes, for example, studies on achievement gaps between males and females (e.g., Benbow & Stanley, 1980; Berg et al., 2020; Englehard, 1990; Fennema & Sherman, 1977; Hyde & Mertz, 2009) and the social factors impacting gendered relationships to and in mathematics (e.g., Esmonde et al., 2009; Leyva et al., 2021; Llewellyn, 2009; Reyes & Stanic, 1988; Solomon et al., 2016). I wager that one reason for this plurality of approaches (and the incommensurability of their constituent findings and results; also see Damarin & Erchick, 2010) is the inability of existing theoretical perspectives for getting to the root of the problem (the point-de-capiton of the discourse). After all, “la femme n’existe pas.” So, what—exactly—are gender researchers in mathematics education researching then? And what are the consequences of their research?

---

1 According to Lacanian theory, a point-de-capiton is the “quilting point” of a speech: a signifier that stops the slippage of the signifying chain, meaning that the point-de-capiton is the signifier off of which the rest of the speech is quilted or built (Lacan, 1981/1993).

2 This is a famous Lacanian maxim that translates to “Woman does not exist.” As with all Lacanian maxims, this cannot be understood using traditional logics: they are intended to reflect some aspect of psychoanalytic theory that reflects a counter-intuitive observation. In the case of this maxim, it simply articulates the original feminist position: that “woman” has the signifier “man” in the middle of it. Thus, Lacan argues that there is no “woman,” there is only woman (Lacan, 1975/1998). This maxim is roughly homologous to the recent trend amongst feminists in writing “womxn.” Thus, the question I ask in this dissertation is roughly homologous to: “What is womxn’s mathematics?”
In this study, I offer a quilted-speech—a statute of statements produced by speculative logic (Hegel, 2010, 2015)—that confronts the continued proliferation of research on gender and mathematics by conceiving of its corpus as a sublimated form of the fundamental hysterical question: “What is a woman?” Or, more precisely from a psychoanalytic perspective within the mathematics education context, “What is a feminine quilted speech of mathematics?” In this capacity, I suggest a new way of approaching this question, using Lacanian psychoanalysis and ideological criticism to revisit and critique the development of “gender and mathematics” research over the past fifty years, in order to investigate the progression of sexual difference sublimation that has ideologically been promoted by the field of mathematics education.

In many ways, the present study’s theoretical commitments and motivation are in a similar vein to work done by Appelbaum (1992) and Bibby (2010). Appelbaum (1992) elucidates that “The gendered interpretation of particular problems of mathematics education within [the context of American militaristic and economic competitiveness] also significantly influences the construction of gender as a category itself” (p. 170). Bibby (2010) has argued for a pre-Oedipal mathematics, which seeks to find a pre-Oedipal (but still masculine) mathematics education, where the pre-Oedipal male psyche is kinder/softer/loving; although this is an encouraging and (probably) a more realistic future goal for the field, the present study goes further into the limits of Lacanian theory by positing a feminine-quilted-speech rather than what Bibby hypothesizes, which can be seen as “a pre-Oedipal-masculine-quilted-speech.”

---

3 In this study, when I use the signifier “mathematics,” I mean precisely school/institutional mathematics.
4 Methodologically, the end of an ideology critique should contain a question asked because of the analysis. This question serves that role in the present study. I develop the theoretical basis for this question in this chapter and Chapter II.
5 These works were not included in the artifact search for the present study as the former is a dissertation and the latter is an edited book chapter. The artifact selection strategy utilized in the present study is detailed in Chapter II.
1 How This Study is Organized

This study is organized as a contrast of speeches: on the one hand, the speech that has existed over the last fifty years, and on the other hand, a new speech that I articulate. This decision was made in order to align with the Lacanian view on language and jouissance, namely, that speech produces an excess: “that speech exceeds the signifier” (Tupinambá, 2021, p. 53, my emphasis). Lacan developed this view in his later teaching, such as in Seminar XVII: The Other Side of Psychoanalysis, Seminar XVIII: On a Discourse that Might Not Be a Semblance, Seminar XIX: …Or Worse, and Seminar XX: Encore (On Feminine Sexuality; The Limits of Love and Knowledge). In other words, analyzing artifacts’ specific signifiers by themselves would not capture the effect of the signifier over time and over the breadth of artifacts that I consider in the present study; the only way to avoid this is to consider the entire quilted-speech of all artifacts together, and then drawing examples from specific textual references. To frame this contrast of speeches, the present study proceeds in the following way:

- In Chapter I, I introduce the concept of the Lacanian ideology critique, as well as introduce the issue of gender in mathematics education. I conclude by articulating an autoethnographic interlude as a psychoanalytic exercise on myself, in order to illustrate

---

6 In the next section, I describe why I use the term “speech” instead of “discourse.” For the non-Lacanian reader, they should be taken as roughly equivalent in the context of this study.

7 Jouissance is sometimes translated into English as “enjoyment” but the French word is much more dynamic in its meaning, referring to a specific concept in the French language. It could—in English—mean enjoyment, pleasure, pain, or excitation. In the present study, I mostly use jouissance to remain adherent to the original French. In either role, the concept relates to a complex system of libidinal investment of energy. As a rhetorical device, I sometimes use the word enjoyment, to signify the concept slightly differently in some instances.

8 The crux of this claim, that speech produces an excess, is necessary for the conclusions drawn—specifically, with respect to jouissance and ideology. Lacan calls this language-of-enjoyment lalangue and uses it to refer to the effects of language in the unconscious—one of producing an excess of jouissance, which is also what properly constitutes ideology (see Lacan, 1975/1998; Žižek, 1989/2008a, 2022). The reader will see at the end why I have made this theoretical commitment, with justification provided retroactively by Chapters IV and V.
the degree to which I attempt to be adherent to the psychoanalytic paradigm, and what this study itself represents within the psychoanalytic paradigm.

- In Chapter II, I articulate the first speech—the discourse of the artifacts. In this chapter, I summarize the development of the last fifty years of gender research in mathematics education, as evidenced by language used explicitly by the artifacts. I do not deviate from the language nor logic used by the artifacts in their articulated, existing speech.

- In Chapter III, I introduce the theory and methods for a Lacanian ideology critique, also including some background on relevant Lacanian concepts as a precursor to the following chapters.

- In Chapter IV: I articulate the second speech—the Lacanian ideology critique of the artifacts in Chapter II. This chapter contains the analysis and findings of the study.

- In Chapter V: I conclude the present study by commenting on the findings, articulating a possible basis for a feminine-quilted-speech, and make concluding comments on the implications of this study and future directions for my research. In keeping with the perspective of a Lacanian ideology critique, I attempt to face the possibility that, because of the effects of ideology, this study was already delineated for me beforehand. Chapter V also shows the extent to which what this study has attempted to produce is a speech of totality, and it has resulted as a totality with failures (see Baldino & Cabral, 2006; Pais, 2011).

2 A Note on Lacan’s Works Referenced Herein

Many of Lacan’s works remain, to this day, without official English translations. His (arguably) more popular works, including his Écrits (“Writings”) and more popular Seminars, have been officially translated into English, with the entire project being edited by his son-in-law
Jacques-Alain Miller; these works have been published by Norton and Polity. These official translations, however, only cover a fraction of Lacan’s total corpus. In the present study, I also draw on some of his unofficially translated texts. Cormac Gallagher, an Irish psychoanalyst, took up the task of translating the transcripts of all of Lacan’s *Seminars* from the original, unedited French manuscripts, but he did not date any of the finished translations. These are available at [www.lacaninireland.com](http://www.lacaninireland.com) thanks to the digitization work of Tony Hughes, and have been used when official English translations were not available; these texts are cited parenthetically as “Lacan, yyyy/n.d.-x” where “x” is an alphabetical index to list them chronologically from their original delivery year. For example, *Seminar XIV: The Logic of Phantasy*, originally delivered during the academic year 1966–1967 and which only exists in English as a non-dated Gallagher translation is cited parenthetically as “Lacan, 1967/n.d.-b” and in the reference list as “Lacan, J. (n.d.-b). … (Original work published 1967).” I make this note because the “original work published date” is not an official publication date, but rather the closing year of the original French seminar; thus, my citation style for the Gallagher translations deviates slightly from the APA 7th style rules, which I do to increase the ease of which the reference list can be navigated by the reader.

3 **Speeches or Discourses?**

In the present study, I use the term “speech” to refer to the quilting of linguistic signification as a whole and over time; furthermore, this concept reflects the role of language in supporting and reproducing ideology (e.g., Baldino & Cabral, 2018). The term “speech” could be interpreted as roughly equivalent to “discourse,” although its full meaning goes far beyond this immediate comparison. Speech, in the psychoanalytic and ideological contexts, does not refer to a rhetorical address of spoken word—rather, it more refers to the way “Word” is used in a
theological context, namely that a “Word” is a message, along with all of its nuances, unsaid implications, and opaque interpretations—all of these taking on a cumulative effect over time and for a large group of people. This is because a crucial aspect of “speech” is *jouissance*, roughly translated into English as enjoyment.⁹ In this way, a “speech” is everything said and unsaid, and by doing so, a speech reflects the ideological commitments that individual signifiers cannot contain. In other words, in order to do an ideology critique at the psychoanalytic level, I must be concerned with “discourse” at the level of the unconscious, what Lacan (1975/1998) has called *lalangue*. Lacan elaborated that, because the unconscious is structured like a language (not by a language), ideological commitments in the unconscious (which express themselves as symptoms, that is, at the level of the Symbolic; see Žižek, 1989/2008a) are analyzable with a linguistic device that exceeds signifiers: a speech, specifically, a quilted-speech. *Lalangue* (Lacan, 1975/1998) relates the way that the unconscious libidinally invests the *surplus-jouissance* of ideology, the *jouissance* implicated and produced in a speech, to the actual signifiers used by subjects: in the case of this study, I use the texts of the artifacts analyzed as the signification evidence of the *lalangue* of researchers who have written “the speech” of gender research in mathematics education over the past fifty years—viz. the speech I articulate in Chapter II.

Discourse analysis, as typically conceived in educational research, stems from the work of Foucault, who sought to “get away from” the paradigm of ideology critique. During the 1960s and 1970s, the rising influence of postmodernism meant that Foucault’s brand of discourse...
analysis seemed better suited to critique the concepts of knowledge and power. As I describe later in the present study, one of the marks of postmodernism is that master signifiers are rejected in favor of what might be called “local signifiers,” meaning that master metanarratives are rejected in favor of local metanarratives. The irony here is that Foucault’s brand of discourse analysis ended up becoming a sort of privileged methodology or “master signifier” in critical academic work (Vighi & Feldner, 2007). In the present study, I do not employ the concept of discourse in the Foucauldian sense, because Foucauldian discourse does not include the notion of enjoyment. In Žižek’s (e.g., 1989/2008a) work to bring together Marxian and Lacanian theories, he develops a psychoanalytic notion of ideology that dialectically (through Hegel) relates the manifest/Symbolic content of language and the speaking act with the “uncanny”/Real residue that, for Lacan, necessarily constitutes the Symbolic order. In other words, because the Symbolic and Real are dialectically concomitant, the study of ideology must not only include language, but also must include the enjoyment of that language. For Žižek, this enjoyment is what properly constitutes ideology as such. This “Real” kernel of obscene/disavowed jouissance (what is impossible to be said) is a crucial dimension of ideology critique, because it is in the superego’s “unconditional injunction to enjoy” that “the subject’s full potential ideological potential is realized” (Vighi & Feldner, 2007, p. 149). In this way, ideology critique is radically incompatible with Foucauldian discourse analysis because of the Real “non-discursive kernel of jouissance (fundamental fantasy)” (Vighi & Feldner, 2007, p. 153). Or, said in short, discourse analysis only takes up language qua Symbolic and does not consider the “language of desire” (Vighi & Feldner, 2007, p. 153), the latter of which is necessarily non-discursive.

For this reason, I orient my critique in the present study at the level of speeches. By doing so, I am equipped to show how the speech in Chapter II reflects one of the most crucial
dimensions of ideology: that our speeches—qua actions—as researchers form the necessary supports for ideology to continue. This is a slightly different way than Lacan used the concept of “speech” in his original work, but within the context of an ideology critique, this use of the concept is warranted.

4 The Effects of Ideology

The most ideological position one can take is to believe that there exists a position outside of ideology; rather, we are always-already “in” ideology (e.g., Žižek, 1989/2008a). In the present study, I critique the ideologies presented within the literature that constitutes the primary corpus of research on gender and mathematics over the last fifty years. My ideological critique of “gender and mathematics” research is positioned against ideologies that disavow the role of political economy in the creation and reification of the signifier “woman,” because this signifier is an attempted (and failed) stabilizer of sexual difference (Žižek, 1994/2005) which must, paradoxically, be created in order for any subject to engage with/in any mathematics—in the capitalist mode of school and the neoliberal university—by creating a masculine speech of mathematical identity onto which it is possible to quilt “woman” qua a semblance of sexual difference. I take this position apropos of political economy because, as I show in the present study, most research on gender has been done with specific reference to the success/failure dichotomy that persists as the dominant mode of school. In other words, in the present study, I critique the pursuit of “gender equity” research amidst an educational system that is built on a foundation of inequity (Baldino & Cabral, 2006; Pais, 2012). Or, said another way, I show that

---

10 The educational philosopher Jim Garrison once told me, “Culture has you before you have it.” This is homologous to the mechanism of ideology.

11 The masculine-quilted-speech is a phrase I shall use regularly throughout the dissertation; it is my own adaptation of the term identity-quilted-speech from Baldino & Cabral (2018), on which I expound in the present study apropos of gender.
gender research in mathematics education generally proceeds by pursuing equitable outcomes (e.g., enabling girls’ potentiality for success) without regard to political economy. This position comports with the Marxist feminist approach to women’s struggle (and gender research more broadly), situated—as such—in a condition of material struggle (Sheivari, 2014). I discuss ideology in more depth in Chapter III.

Thus, consider the possibility that the existing corpus on gender and mathematics research does not achieve its intended goal of more gender equity, but that rather—because of the ideologies that have produced the corpus—gender and mathematics research as currently performed symptomatically leads to more alienation and exclusion of subjects with respect to their gender. This is not a radical claim: to confirm it, one only needs to look at the present and violent reaction to gender-equity research in education, most specifically, the reaction to transgender research. It is this historical moment that necessitates a different logic and approach, and I contend that it is the ripest moment thus far in the history of our field. To assist this analysis, I draw on additional authors in the Lacanian tradition whose work focuses on gender and sexuality, such as Alenka Zupančič, Patricia Gherovici, and Joan Copjec.

One specific effect of ideology in the Marxist sense is what Althusser (1976) called *interpellation*, wherein he employs Lacan’s notion of intersubjectivity to describe how ideology, at the level of political economy, “reads”/recruits a subject into the ideology. While I personally do not draw on Althusser regularly, in the present study I draw on the work of Morel (2023) who has developed the notion of interpellation of gender: that is, “reading” a subject into the capitalist ideology of deterministic gender. In the present study, I call this the ideology of *interpellationism*: the act of performing research on gender is itself ideological, assuming a

---

12 I develop the argument for this claim more in Chapter II.
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

priori that the researcher can “read” the (gendered) subject of their research. I employ this notion throughout the ideological critiques in this study to show how the act of interpellation by gender researchers is a necessary ideological support for the reproduction of the other ideologies I critique. For example, in this arrangement, the ideology of interpellationism enables the ideological use of scientism without researchers’ awareness of doing so: that one can “recruit” a research subject into the ideology of scientism qua the assumption that the researcher can “read” the subject’s gender. Interpellationism allows for Lacan’s dialectic of desire to be reconciled within the other ideologies I critique: researchers create the reality they want in their research by first adopting a position of interpellationism, which they do so unbeknownst to themselves because of their desire. As pointed out by Morel (2023), this employment of Althusser is useful in “undoing” the interpellation of gender with ideologies of sex. This false conflation of gender with sex (viz. sexual difference) is a product of signification, a form of substitute enjoyment in the act of Symbolically overdetermining Lacan’s Formulas of Sexuation, as Žižek (1994/2005) has said: “[I]f it were possible to symbolize sexual difference, we would have not two sexes but only one. ‘Male’ and ‘female’ are not two complementary parts of the Whole, they are two (failed) attempts to symbolize this Whole” (p. 160).

13 Jacques-Alain Miller, in the preface to Lacan’s (1974/1990) Television, recounts when Lacan said: “He who interrogates me also knows how to read me” (p. xviii). In other words, the act of the interrogation, such as that of the researcher interrogating the gender of a person, presupposes (falsely) that the interrogator knows how to read the subject of their interrogation. This false belief is what I call the ideology of interpellationism in the present study. Said another way, the act of interrogating gender creates the belief in the readability of gender: the researcher “knows,” but this knowledge is not knowledge of the interrogation subject (although the researcher believes it is). Rather, this knowledge is a disavowed knowledge of jouissance, particularly a masculine jouissance, one of signification, that posits that the subject of the interrogation can be read, and thus, signified by the researcher.

14 The dialectic of desire relates the unknowing subject (S) to the object-cause of desire, objet petit a (α). The diamond (◊) is a dialectical operator in Lacanian Algebra. An object cause of desire could be a trait, object, signifier, etc. However, since desire is always the desire of the Other, this desire is elusive. A fuller explanation will be provided in Chapter IV.

15 It appears that Morel (2023) draws the term “undoing” from the work of Butler (e.g., 2004), however Butler’s contribution to Morel is not necessary for my employment of Althusser and Marx, so, I omit Butler in the present dissertation. Notwithstanding Butler’s contributions to gender theory, I instead draw on original Lacanian texts.
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

Interpellationism thus affirms the Marxist conception of ideology: our actions are the necessary supports for ideology to reproduce and continue—that is, ideology has already determined beforehand what our actions shall be. This is germane to the present study because I take the Gherovician position that gender is a self-representational and existential sinthome: vis-à-vis interpellationism, the subject thinks they can “read” the gender of another just as they think they have “read” their own gender (see Gherovici, 2017). This is indeed what the “read” subject wishes, too, although a successful “reading” is impossible because the subject speaks “from the Big Other” to “no one in particular.” In short, this “reading” of the subject is always-already a “misreading”—or, perhaps, a “miss(ed) reading.” As Morel (2023) concludes, “gender is reified via interpellation… and hence [is] a consequence of ideology” (p. 112, my emphasis). Interpellationism is, thus, an ideology of “reading” an identity-quilted-speech (see Baldino & Cabral, 2018).

5 Speech, Ideology, and Political Economy

Desire is what opens up an understanding that—in language—speech exceeds the signifier. The excess produced is precisely that of jouissance. It is in the (masculine) desire to signify that an excess (qua surplus-jouissance) is produced, leading to the ability of speech to exceed the signifier (see Tupinambá, 2021). This excess jouissance is what properly constitutes ideology (Žižek, 1989/2008a; 2022). Thus, the task of the present study is essentially to critique the desire of researchers undertaking the task of gender research in mathematics education, much

---

16 Speaking “from the Big Other” is the effect of language in constituting subjectivity. Lacan developed this notion drawing on Saussurean linguistic theory. The Big Other positions the subject in the world, through language, and it is from this position that the subject speaks. Speaking “to no one in particular” means that the subject thinks they are addressing someone, but in psychic reality, they are just speaking. In other words, the unconscious is the only part of the human body that keeps us from being merely speaking-machines, or “shallow mechanical dolls” (see Baldino & Cabral, 2018). The phrase “to no one in particular” is a joke, in French, on Lacan’s name, referencing how, in a psychoanalytic session, the patient thinks they are speaking to Lacan, but in fact are merely speaking. The French “à la cantonade” means to no one in particular, and by emphasizing the first syllable, Lacan makes a joke on his own name: “à la cantonade” (Lacan, 1973/1981, p. 208).
of which is related to equity because the question of “gender and mathematics” originated with a question of equitable or inequitable achievement and ability. Thus, I ask “what is it that these researchers want?” In order to attempt to investigate this question, I must consider the level of speech rather than the level of discourse. In other words, whereas discourse analysis is more concerned with the level of signification qua articulation, ideology critique is more concerned with the “empty” or “master” signifiers that allow for the quilting of the discourse—or, more correctly, it is within the level of desire (and thus speech) that the ideology hidden behind discourse can be identified. The key affordance this allows in the present study is that of avoiding the trap of identity politics in my analysis, and thus can orient the present study at the level of political economy: the crucial level at which an ideology critique must be placed, because it is at the level of political economy that jouissance can be accurately theorized, that is, in what people are doing can be seen what people are enjoying.

In short, material conditions (such as the materiality of the body) produce ideology (such as the ideology of gender) by a disavowal of that same materiality. In its place, ideas—such as the idea of identity—are installed. This approach is incompatible with the psychoanalytic perspective because there is no sexual relationship, particularly not one which would stabilize the man/woman/trans/whatever identification of gender in any unconscious sense. Rather, these identification games (that is, games of identity politics) are symptoms of sexual difference in a material condition. The ideologies that I critique in the present study do not reflect an accurate picture of the psyches of the subjects represented in the data of the analyzed research. Thus, a Lacanian ideology critique oriented at the level of political economy is aimed at identifying the underlying ideas in the quilted-speech of the existing literature (analyzed herein as data) qua
disavowed material relationships, such as the material relationships of the bodies of students and
teachers involved in the studies that lead to the production of the articles I analyze herein.

6 The Masculine-Quilted-Speech and the Signification of Gender

I introduce the term *masculine-quilted-speech* (MQS), which is the character of a quilted-
speech that is predominately oriented in the masculine side of the Formulas of Sexuation (Lacan,
1975/1998). The masculine split-subject’s phantasmic attachment to the object cause of desire
(objet a), which is one of the relationships outlined by Lacan on the masculine side of the
Formulas of Sexuation and which is also described as masculine phantasy (Lacan, 1967/n.d.-b),
is the *transcendental/enabling condition* in the psyche for the masculine-quilted-speech. Two
functions exist in masculinity: that of the barred/unknowable subject (ɔ) and that of the phallus
(Φ). The formula and these functions orient how the subject becomes embodied in a masculine
way (see Morel, 2023). In the next section, I describe the feminine side of the Formulas of
Sexuation. Apropos of the masculine, the process of becoming embodied is exceedingly
precarious: the subject is only constituted by incompleteness, unknowability, and the status of
being “subject to” the ego and its Imaginary demands; these demands are amplified by the
comparison to other masculine bodies, as exemplified in the hegemonic discourse of the “Alpha
Male” and so forth. For this reason, the masculine subject engages in symptomatic behavior of
control and domination. The “masculine identity” is thus one of quantifiability and accumulation.
Symbolically, then, the masculine subject identifies with the signifier 1. Lacan (1967/n.d.-b)

17 In Lacanian theory, the phallus (Φ) is the privileged signifier of Lack, and thus also is the signifier that
initiates sexual difference by allowing all other signification to proceed. The Φ does not signify sexual difference,
but rather is the signifier of sex-unity, or rather, it signifies the (failed) attempt at achieving a universal One. This is
because the Φ signifies sexual difference precisely by signifying that it cannot signify sexual difference, thus the Φ
signifies a Lack that the subject attempts to “make up for” with the help of other signifiers (such as man and woman,
for example).

18 Dialectically, this precariousness is “made up for” by not acknowledging it, which is why the notion of
“precarity” is more commonly associated with feminist thought. Symptoms of male hegemony are the result.
elaborated on this concept in *Seminar XIV: The Logic of Phantasy*, wherein he describes the structure of the masculine phantasy. This phantasy begins with an *objet petit a* (an Imaginary object of desire, an $x$ which might satisfy the $\Phi$), which is repeated through language in the form of the manifest content of the phantasy. By satisfying the $\Phi$, the masculine psyche thinks that this $x$ might be that which stabilizes himself in the Symbolic and permanently forecloses the existential dread of the Real.\(^{19}\) Said another way, the $\Phi$ is the signifier that installs the logic of signification itself, thus enabling all other signification to proceed, resulting in quilted-speeches that signify.

Whilst this signifying repetition of the $a$-phony is largely unconscious, the conscious is meanwhile engaged with a Symbolic preoccupation of the $1 + a$ which signifies accumulation through an “and one” of the $+ a \ldots + a \ldots + a \ldots$. This process does not repeat indefinitely, however, for an indefinite repeating would signify the feminine position: that of the emergent. Since this process terminates, it ends with a signifier as well, that of the knowing subject (viz. the masculine phantasy is that of the $\mathbb{J}$ becoming the Imaginary $\mathbb{S}$, the knowing subject). In the Symbolic, this process results in the masculine psyche believing that he has, at the end, achieved the status of having given himself over to the Big Other, of having achieved embodiment in the signifier that the Big Other has Imagined the masculine subject to be, that of the (phallic) law itself (Lacan, 1967/n.d.-b). The jouissance that accompanies this process is what is called the masculine jouissance, and is thus teleological (Žižek, 1994/2005).\(^{20}\)

---

\(^{19}\) As Lacan (2011/2018) says in *Seminar XIX: ... Or Worse*: The $\Phi$ function initiates the foundation of sexual difference by causing the subject to search for the existence of an $x$ (the mythical primal father who has the $\Phi$) which might satisfy the function, thus filling masculine Lack. Because of this, the “notion of existence only emerged with the intrusion of the mathematical Real as such” (Lacan, 2011/2018, p. 158). In other words, this search for a possible $x$ overdetermines the precarious and impotent teleology of the masculine position.

\(^{20}\) This of course does not happen in reality, because the masculine psyche does not formulate himself as subject to the Big Other, but rather envisions that he is the Big Other himself. In the psyche, however, the reverse takes place: he believes that he is the Big Other *itself*. For this reason, Lacan orients the function of the “subject of” the Big Other on the feminine side: $\mathbb{S}(\mathbb{A})$, the one who *objects to* the Big Other ($\mathbb{A}$), i.e., the feminine complaint,
In other words, the masculine-quilted-speech is built off of the signifier 1—that a quantifiable identity exists that is accumulable. Because the logic of this speech is one that posits creation, that is, in it posits creation in order to enable accumulation, the masculine-quilted-speech is also what underpins other speeches of capitalist accumulation, such as neoliberalism, which I describe in Chapter IV. The signifier “woman” is created within this speech, thus enabling discourse on gender to proceed, itself having been quilted off of the notion of biological sex. This led to the beginnings of the speech on gender to be one of conflation of gender and sex. The masculine-quilted-speech performs this function in order to disavow castration, which occurs as a function of sublimation: “[I]t is always through identification to the woman that sublimation produces the appearance of a creation” (Lacan, 1967/n.d.-b, p. 143). Furthermore, this speech employs the ideology of interpellationism so that speakers of the masculine-quilted-speech believe that they can read the gender of others.

However, this is an Imaginary knowledge, which is precisely the same reason that it is integral to the masculine-quilted-speech: “The Imagination of the subject of knowledge, whether it is before or after the scientific era, is a male forgery… male insofar as it has some of the characteristics of impotence, that it denies the minus something around which there is constructed the effect of causation of desire, which takes this minus for a zero” (Lacan, 1967/n.d.-b, p. 144). In other words, to be male is to be subject to the Imaginary, to be a subject of Imaginary knowledge. The minus something invoked by Lacan here is the –Φ, the function of castration, which is the symptom of the existential burden placed on the subject by the Big Other through language. Mistaking the –Φ for 0 is properly what constitutes the delusion of thinking the interrogation of the phallus. The feminine side, which I describe in a later section, is the only position where the Big Other can be seen as imbued with Lack in its very essence. As a result, woman may object to it, for she sees its precarity as it truly is.
(Lacan, 1967/n.d.-b) and also enables the psychic investment in interpellationism. This occurs because of the capitalist ideal that mistakes the body’s materiality as signifying “readable” gender positions such as man and woman, positions that were quilted by the masculine-quilted-speech itself. The masculine reading of the subjective register, the idea of the “couple” (that two become one flesh), is a masculine attempt to capture the Imaginary—the Imaginary knowledge—from which place the subject can see nothing more than their own Imaginary, their phantasy, their self “auto-production” within the Symbolic.

Crucially however, by not reflecting on the Symbolic, one necessarily creates a “toxic version” of the Symbolic that forecloses others’ Imaginaries, specifically those Imaginaries which do not reflect an alignment with the normative Symbolic installed by capitalist political economy. This means that the masculine reading of the subjective register is both a symptom of capitalism and an attempt (within the masculine way) to maintain the illusion of the sexual relationship, which doesn’t exist (see Lacan, 1975/1998). However, this is merely the reason that heteronormativity is intricately bound to political economy. “The ruling ideas [of an epoch] are nothing more than the ideal expression of the dominant material relationships, [that is, the ruling ideas are] the dominant material relationships grasped as ideas” (Marx & Engles, 1846/1968, emphasis added). Failure to recognize this produces ideology. Given this, the “idea of the couple” through a masculine-quilted-speech reading, is from a Marxist perspective nothing more than the idealistic grasping of the material production of bodies. Thus, heteronormative ideology signifies a material arrangement of the reproduction of bodies so that capitalist accumulation

---

21 For example, “Be who you want to be, as long as it doesn’t foreclose the mechanism of capitalist accumulation.”

22 The digital version of this text is not paginated. This quote came from Book I (A Critique of the German Ideology), Part I (On Feuerbach: The Opposition of the Materialist and Idealist Outlook), Chapter B (The Illusion of the Epoch).
may be installed. In other words, the ideology of capitalist accumulation is only possible when quilted off a stable signification of sexual difference: man and woman. The “idea of the couple” supplants the material relation of sexual difference, resulting in heteronormative ideology, that there is a “lock and key” aspect to desire and gendered embodiment.

We try to stabilize sexual difference by signifying woman (who doesn't exist) with a (-1). Man thinks he is signified by 1, and therefore it would be possible to signify his negation as well. However, both are failed symbolic attempts. Man and woman are both in the infinitesimal space between 0 and 1, caught in the difference of the subtraction itself—looking for the smallest whole number that would bind them; yet even 1 is out of reach. Man looks towards the 1 (the phallus), and the woman looks towards 0 in spite of the (masculine) quilted speech of mathematics that tells her to look the other way (with the phallic promise that she can be signified by man's significatory negation). This promise, like all phallic promises, fails; she forces this (-1) at great trauma to herself, and hysterical discourse on gender proceeds as a symptom. The man subjects himself to the phallic demands by structurally identifying with 1 through a phantasy, and she objects to the phantasy of identifying with (-1). Her gaze at the 1 is her feminine complaint, her phallic interrogation. She, meanwhile, is merely more proximate to the 0, and this is all: their sexual difference is merely difference as such. The (masculine) quilted speech of mathematics creates objects, presenting them to woman, saying: “Here is the object, to which you may object, if you dare.”

7 The Possibility of a Feminine-Quilted-Speech?

In light of the preceding, what might a feminine-quilted-speech (FQS) be? The feminine side of the Formulas of Sexuation (Lacan, 1975/1998) posit the feminine position as that which interrogates the phallic structure, asking it “Who is this that you are trying for me to be” (my
interpretation)? Feminine jouissance, accordingly, is one which cannot be signified; it can only be experienced. Feminine jouissance is that which arises through a distributed network of particulars (Žižek, 1994/2005); it is not teleological because it cannot be signified. Thus, a “feminine-quilted-speech” is somewhat paradoxical, and apropos of mathematics education, it may only be possible by not speaking about anything in particular. This comports with the Hegelian influence in Lacan, specifically in that a feminine-quilted-speech would implicate a diminishing connection to both mathematics and gender insofar as both are signified through masculine-quilted-speeches. Thus, a feminine-quilted-speech can be seen as a type of psychoanalytic rhetorical device that serves to show that masculine-quilted-speeches only posit a total universe of discourse retroactively, meaning that they ideologically posit their own consistency from within their own logics.

The paradoxical nature of a feminine-quilted-speech would emerge through speaking of experiences of jouissance that are not contained within the speech. For example, a feminine-quilted-speech of mathematics might include speaking “around” women’s experiences of achievement and participation in mathematics—but the jouissance associated with both of these are necessarily masculine, insofar as their referent is a teleological sense of “belonging in mathematics.” Hence, a feminine-quilted-speech of mathematics would signify this paradox—because in so signifying, it would revert to the masculine. For this reason, the feminine-quilted-speech would seek a beyond-of-the-speech that dialectically relates the teleological masculine jouissance to the feminine jouissance-which-cannot-be-signified. A possible quick gloss of this dialectic might be that the feminine-quilted-speech may re-center the Real, whereas the masculine-quilted-speech centers the Symbolic. For Lacan, the Symbolic and the Real are always concomitant, thus the Real is only thinkable through dialectical logic. Insofar as the scientific
speech is masculine (qua teleological jouissance and its associated retroactive imposition of the consistency of its own signification), the Symbolic is privileged. I would suspect (before performing the analyses in the present study) that the feminine-quilted-speech would seek to re-center the masculine-quilted-speech through a dialectical intrusion of the Real, which is indeed what Lacan (2011/2018) has said is the relationship between mathematics and existence. Since this existence is unstable, a feminine-quilted-speech would not seek to signify anything, not seek to point anywhere, and would not seek to achieve accumulation in the capitalist sense; rather, I suspect that a feminine-quilted-speech would seek to show the inconsistencies in the phantastic “universe of discourse” posited by the masculine-quilted-speech of mathematics (Lacan, 1967/n.d.-b). I might say that a feminine-quilted-speech is one that is potentially totalizing insofar as it would show that there is no universe of discourse wherein the signifier can signify itself (see Lacan, 1967/n.d.-b, 1975/1998); in other words, a feminine-quilted-speech might show that the masculine-quilted-speech is itself incomplete, inconsistent, and only self-referential to the masculine position, leaving out the feminine jouissance entirely.

A quick example of this might be, in concert with the findings of Baldino and Cabral (2006), that “women’s equity” is not in fact a call for equity, but is rather a call for women to “become men.” In other words, what might gender equity be, if not a gender homogenization with the masculine position as its referent? Thus, a feminine-quilted-speech of mathematics might be one that does not achieve a totality but rather one that bifurcates the speeches of the mathematics education research field into purely masculine and purely feminine, with the feminine speeches being the dialectical “glue” that subsumes the masculine speeches under them by reaffirming the Real inherent in the Symbolic. If true, then—as a research tool—the feminine-
quilted-speech would seek to show that the masculine-quilted-speeches are only self-referential and self-totalizing, thus leaving the feminine jouissance out of the speech.\textsuperscript{23}

For my part, I see this as useful in performing an ideology critique in a field such as mathematics education wherein the quilted-speech is primarily masculine, and thus reflects masculine jouissance in its quilting.\textsuperscript{24} Apropos of ideology, I make this claim because a feminine-quilted-speech would not lead to any accumulation—no “results,” no “knowledge” (the signification of which is masculine, see Lacan, 1967/n.d.-b); it would lead nowhere, which is wherein its importance lies—that of negating capitalist accumulation in mathematics education (also see Martin, 2021). Apropos of the present study, my search for a feminine-quilted-speech might lead to the results of this study “pointing nowhere,” except that there is both truth to artifacts that claim male superiority in mathematics (e.g., Benbow & Stanley, 1980) and those that claim that women can do just as well as men in mathematics (e.g., Fennema & Sherman, 1977); in the former, the feminine-quilted-speech might show that women do not masculinize themselves enough to be qualified as successful in mathematics, and in the latter, insofar as the timeframe of the study could capture, women are able (in the neoliberal way) to masculinize themselves enough to at least temporarily be (as) successful (as men) in mathematics. The Hegelian interpretation of this paradox is that both are true, and the Lacanian interpretation of this paradox is that the Formulas of Sexuation are working precisely as theorized.

8 **A Note on Psychoanalytic Language: The Inescapable Trap of the Signifier**

We are nothing but language; our bodies are language because language is the world we inhabit (see Lacan, 1967/n.d.-b). Just as our bodies “use us,” so too does language use us.

\textsuperscript{23} For example, as I developed in the section “The Masculine-Quilted-Speech and the Signification of Gender,” the ideology of neoliberalism produces quilted-speeches that only include masculine jouissance.

\textsuperscript{24} I also suspect that the feminine-quilted-speech shall be useful in revealing the function of mathematics in political economy.
However, language is how we misunderstand each other; the signifier is always “slipping under” the signified. This is why Lacan says that language only ever gives us the ability to “formulate things that have one, two, five… twenty-five… meanings” (Connolly, 2016, 21:21). In the psychoanalytic context, language use is understood through two principles: metaphor and metonymy. *Metaphor* is the principle of selection, and *metonymy* is the principle of combination. These two principles are the limits with which we can use language. In metaphor, specific words are chosen to create an effect, whereas in metonymy, words are combined together in a string, functioning co-presently to retroactively assign meaning onto the string at its end. Lacan uses mathematics (what he calls *mathemes*; e.g., $\heartsuit a$ is the matheme that describes the “desiring subject”) to describe psychic phenomena in abstract symbolic terms only. His rationale behind this is that use of linguistic signifiers as the sole way of talking about psychic phenomena overdetermines them by way of the signifiers chosen. Thus, “[By introducing] symbols, mathematical or otherwise, [requires that you have] to explain what you are going to do with them” (Lacan, 1975/1988, p. 2). In positioning psychoanalytic thinking about language in this way, Lacan is ensuring that psychoanalytic concepts are not singularly signified, because such unitary signification would lead to false intuitions—*qua* singular, linguistic significations—about psychoanalytic concepts.

This leads to certain linguistic consequences for the present study. In writing it, I have no choice but to let language “use me” *qua* causing me to rely on the devices of metaphor and metonymy. Further, these choices are not meant to *provoke* but rather to *evoke*—to evoke a

---

25 In the commonplace use of the word “metaphor,” this principle of selection creates the metaphorical transformation present therein. For example, consider the famous Shakespearean line, “All the world’s a stage.” The word “stage” was selected, through the device of metaphor, to signify the world as having actors in it. By contrast, a different metaphorical construction of the same passage could have read “All the world’s a canvas,” however the signifier “canvas” would not allow the further metaphorical development of the actors being engaged in performances, which was Shakespeare’s point in writing the metaphor.
certain response in the reader. In this way, I use metaphor and metonymy (particularly in Chapters IV and V) to draw awareness to the inescapable trap of the signifier: that the signifier continues to slip under itself until a master-signifier (Lacan, 1991/2007b) is reached in the chain. This is the goal of psychoanalytic discourse: to investigate, analyze, and critique the identity-quilted-speech (Baldino & Cabral, 2018) that constitutes the discourse of a community—in this case, the discourse of the mathematics education research community. In short, this is the difficulty of discussing matters relating to the unconscious or ideology: that we are always-already “in the inescapable trap of the signifier.”

A final point to make regarding psychoanalysis and the present study: namely, that it is critical to employ psychoanalytic theory at this point in the history of our field, because the first fifty years of our research has been based heavily on a “discourse of science,” precisely as evidenced by the ideological motivation of our field having been built on a “science of treatment” (Pais, 2012, p. 53). Lacan has elucidated how psychoanalytic discourse is only thinkable as an “after” result of the scientific discourse, in that the scientific discourse has posited the existence of the “I” as a subject without neurosis (Lacan, 1967/n.d.-b). In psychoanalysis, there is no subject-position outside of neurosis. Thus, a psychoanalytic ideology critique at this point in the history of gender research in mathematics education, as I offer here, reveals the fetishistic disavowal26 committed by gender researchers, which they have done so

---

26 Žižek (1994/2005) develops the notion of fetishistic disavowal to refer to a specific form of enjoyment that comes from transgression. It is this fetishistic disavowal that holds a community together, thus causing this enjoyment to be related to the fetish of the specific transgression: “What ‘holds together’ a community most deeply is not so much identification with the Law that regulates the community’s ‘normal’ everyday circuit, but rather identification with a specific form of transgression of the Law, of the Law’s suspension” (Žižek, 1994/2005, p. 55, emphasis in original). In other words, fetishistic disavowal is the act of “pretending to pretend to believe,” for example, “I know very well that [blank isn’t true], but still, I can believe that I believe that it is.” The specific jouissance is in the “believing that one believes” despite unconsciously knowing that the opposite is the true case. Žižek argues that fetishistic disavowal is one of the purest forms of ideology today. In the case of gender researchers in mathematics education, this transgression might be, for example, the act of performing gender research whilst knowing that the research does not, in fact, accomplish its espoused outcomes of a “greater good” of “gender
unbeknownst to themselves, under the guise of the scientific discourse that has preceded this dissertation.

9 Traversing the Phantasy: An Autoethnographic Interlude

So, how is it that I “got here” as a young researcher? What motivated this dissertation? I believe that, because of the effects of ideology, any artifact that we produce as researchers reflects our own material experiences and psychic realities. For my part, I grew up gay and progressive in the rural American south—quite a conservative situation to be in. This difficult mismatch led me to have a peculiar relationship with mathematics that has continued from my childhood to this day. In school, I was not good at sports, and I had difficulty engaging with the other students, particularly the other boys—those who shared the same gender with which I desperately wanted to represent myself. My mother is an applied mathematician and part-time mathematics college instructor, and as such has worked in highly gendered and oppressive situations throughout her life. Her insistence that her children have a “good” relationship with mathematics (in terms of its teaching and learning in school) made an impression on me early in life, and this turned out to work for my advantage. Whilst I struggled to find social credibility in school in other ways, I found early in elementary school that I was quite good at mathematics. I could follow the directions, I was comfortable with numbers, fractions, and variables. This afforded me social credibility that was coded as masculine when I could not seem to be granted any otherwise. In turn, I devoted myself to mathematics in a sadomasochistic way as the content got harder into high school. Nonetheless, I persisted in achieving at the highest levels of equity” and so forth. As I will show in the present study, fetishistic disavowal of sexual difference is one of the primary ways that gender equity research continues to be an important political statement for researchers although it is ideologically fueled primarily through neoliberalism, solutionism, and evolutionism and not espoused as a political goal. For example, “it’s better if more women achieve higher in mathematics” because it is “just” whilst research supporting such a goal does not actually lead to more feminine concrete universality in mathematics education.
mathematics coursework; it was not always easy, but the masculine social coding that this credibility granted me amongst my peers carried me a long way in the social situation of school. As a result, I developed a strange relationship to mathematics and its education: on the one hand, I experienced great enjoyment from being successful in mathematics, of struggling to achieve when my peers could not at the same level. On the other hand, my pursuit of mathematics seemed to alienate me from myself; I seemed to be repressing much of who it was that I wanted to become for the sake of this strange educational content called mathematics. Nonetheless, I started college focusing on the sciences and quickly found an interest in physics and philosophy. In college, after I had come out of the closet as gay for a second time (the first time was in middle school), my pursuit of physics and mathematics seemed again to grant me some masculine-coded social credibility that I perceived myself as desperately needing: in this way, my pursuit of mathematics over my academic career could be seen as a way of me “becoming the man” that I wanted to be.

Fast-forwarding now a few years, I took a job as a mathematics teacher. For six years, I worked in a Deweyan/Waldorf-type school that focused on holistic and experiential education. Amidst this environment, the administration and parents of my students still wanted my work in the classroom to prepare my students for “life in the real world” (read: market). Their primary concerns related to mathematical achievement, proficiency, and fluency—so that, when my students entered high school or college, they would be well-prepared to enter the same high-achieving tracks of mathematics coursework (like those that I had endured myself), so that they would be able to assimilate into the market economy as highly equipped persons.

Notwithstanding my complete respect for these dreams for their children, the psychic contradictions that I increasingly felt over these years caused me to reflect on my own
experiences in mathematics and life that had led me to that situation (as a mathematics teacher, with a master’s degree in mathematics education, well-respected in the school community, and so forth). I found myself wondering, what is the point of all this mathematics education? What is the point of my work? What is the point of my classroom? I saw myself and my work as implicated in that same question. When reflecting on this and other similar questions, in combination with my mother’s own woman’s struggle in the working world of mathematics—and my own dedication to mathematics in childhood as a source of masculine-coded social credibility—I decided that the existential conundrum I found myself in may possibly be answerable if I pursued a PhD in mathematics education. *What was it about mathematics that caused it to be such a potent social force in structuring gender, social, and economic relations?*

This brings us to today: My doctoral training led me to the desire to attempt to answer this question in the form of this dissertation.

As a queer person (and admittedly divergent—read: critical—thinker), I found great potential in Lacanian psychoanalysis. I believe that experiences equip us to “see” or “not see” things in the world that are different from others who have had different experiences. This means that, for me, my entire subject-position is present in the theoretical perspective I take; it is a product of my social interactions throughout life and the language I have developed in response to them. My experience growing up “in the country” with an “old labor democrat” influence led me to reflect on class struggle and economy. My experience being gay and struggling to find my own masculinity (whatever that may mean) led me to reflect on the unseen ways in which gender and sexuality construct and mediate the social-being of the world. I was fortunate enough to have had a doctoral class with Estrella Johnson, where she discussed an unexpected result of her most recent large research study on inquiry-oriented instruction in university mathematics (Johnson et
the active learning intervention that the research team had worked tirelessly to design and test for improvements in learning outcomes had “backfired,” creating a gender gap (with men outperforming women) whereas one had not existed before the intervention. In other words, this new intervention—designed from its beginning to be “more equitable”—had, in fact, operated in the reverse: creating more inequity. This led me to long discussions with Estrella about the gender dynamics in the classroom that may have caused such an effect along gender lines. We arrived at an agreement that it was something to do with the social interactions of gender (and gendered socialization and expectations) under different pedagogical styles that inequitably impacted men versus women in the classroom. Further, we posited that these inequitable effects may likely be specific to mathematics, due to the nature of the content and the pedagogical expectations of formalization, argumentation, and so forth (what I would later learn, from Lacanian theory, is related to the Symbolic psychic realm, which is inherently masculine). We agreed that there was something “unseen” occurring in the pedagogical situation that manifested in gendered ways.

Concurrent with these discussions, I (almost randomly) discovered the work of Alexandre Pais, Roberto Baldino, and Tânia Cabral whilst doing a literature review for an unrelated course assignment. As a result, I realized that I was not the only one in our field who was concerned with such questions regarding the “unseen”—however, before finding their work, I did not even have the slightest idea that scholars existed who were asking these types of questions. I read everything the three of them had ever written, and I did not understand any of it. So, I quickly

\[\text{\footnotesize{27 I did not know it at the time, but this observation is precisely the effect of ideology and the unconscious. The specific context of Johnson’s work had served, without my knowing, as an archetypal example of the relationship between ideology, the unconscious, gender, and mathematics. I consider myself very fortunate to have experienced this combination and sequence of events during my doctoral training, for they have led me to producing this study.}}\]
began reading who they were citing: Žižek, Lacan, Marx, Hegel, Sohn-Rethel, and so forth. I began with Žižek’s (1989/2008a) *The Sublime Object of Ideology*, and almost immediately began writing notes in the margin such as, “This is exactly what I felt when I was a mathematics teacher” or “This is exactly what happens in mathematics education.” It was on page 137, when Žižek had just finished explaining Lacan’s Graph of Desire, that I wrote in the margin, in response to the following quote, “Wow, I think I am a Lacanian”:

> The most radical dimension of Lacanian theory lies [...] in realizing that the Big Other, the symbolic order itself, is also barré, crossed-out, by a fundamental impossibility, structured around an impossible/traumatic kernel, around a central lack [...] In other words,] the *Other itself* ‘hasn’t got it, ’hasn’t got the final answer—that is to say, is in *itself* blocked, desiring; *that there is also a desire of the Other.* (Žižek, 1989/2008a, p. 137, my emphasis)

Seemingly in an instant, my experience of gender, mathematics, and social class seemed to come into frighteningly clear focus. I did not yet know what it meant, but it was at that moment that I knew what I wanted to study. As a result, I have spent the last two and a half years reading all of the Lacanian and Žižekian theory that I could digest. Then, after reading the most influential literature in our field on gender, the focus of this dissertation came into view. The next step was deciding on a methodology, and after discovering that ideological criticism was itself a methodology for performing research, we arrive at the present text.

The present study is concerned with the dimension of the interrogation of the symptom (Žižek, 1989/2008a), or “learning how the sausage is made.” However, I see this as reflecting what Hegel (1807/1977, 2012) said is the true meaning of life—to move from green immediacy to grey conceptuality, or, in other words, an actualization of self-consciousness: the actualization
of universality, not as immediate, but as becoming… and as integrating the ‘otherness’ represented in this dissertation into the reader’s own experience of gender and mathematics education—as affirming the awareness of oneself in the other. Accessing universality is indeed a difficult and radical task (Žižek, 2018). This is precisely the “fate of everything that is written” (Ali, 2018, p. 166): “Writing… is only something that is articulated as the bone of which language is the flesh” (Lacan, 1971/n.d.-c, as cited in Ali, 2018, p. 166). The present study is “written” as bones; it is up to the reader to “read” it with their own flesh.

I articulate the stories in this section precisely because this dissertation is a psychoanalytic exercise: first, for myself, and secondly, for the reader. For myself, this dissertation represents the traversal of my phantasy of which, in this section, I have described the development. For the reader, it represents an opportunity to confront enjoyment and symptom. For both me and the reader, the totality of this study is a quilted-speech that expresses the jouissance with which I have constructed my phantasy as well as that of traversing it. Thus, this autoethnographic interlude is an integral contribution to my traversal of the phantasy that is represented by the totality of this dissertation. For me, as it was for Lacan, the written words of this study are “the limit or shoreline against which the Real breaks into the Symbolic” (Lacan, 2013, as cited in Ali, 2018, p. 166). Thus, this study is—qua written—a material intervention.

10 A Conclusion to an Introduction

Thus far, I have explained how psychoanalysis and ideological criticism join together to provide a critique of the past fifty years of gender research in the field, and the importance of intervening with a psychoanalytic speech at this point in the field’s history. In addition, there is also a personal purpose of this study, namely, to traverse the phantasy created by my experiences and quandaries in mathematics education over my career, with particular respect to gender. To
accomplish this in the present study, I will analyze the most influential literature on gender and mathematics education, looking for ideological elements that are present and suggested by the artifacts, formulating what the ideological purposes of the artifacts might be, when considered from the position of Lacanian political psychoanalysis. The present study will be organized as a contrast of quilted-speeches. Quilted-speeches combine the notion of “discourse” with the notion of enjoyment/jouissance. Jouissance reflects the ideology of a discourse, and so considering the dimension of jouissance enables a psychoanalytic ideology critique to be performed on a quilted-speech, such as the quilted-speech of the community of mathematics education researchers who perform research on gender. This consideration separates the methodology of an ideology critique from that of a discourse analysis (the latter of which would not consider jouissance, and thus would not be able to consider ideology). In the coming chapters, I:

1) Describe the speech of the artifacts, drawing solely on their language and logic (the artifacts as presented; Chapter II), so that the speech can be analyzed (in the present study; Chapters IV and V) with respect to the specific forms of jouissance contained within them.

2) Describe the methods for a Lacanian ideology critique (Chapter III).

3) Articulate a new speech on gender and mathematics education from the perspective of Lacanian political psychoanalysis (Chapters IV and V). This speech will be characterized by a critique of the masculine-quilted-speech and a search for a feminine-quilted-speech.

11 Brief Purpose of the Study

Notwithstanding that gender is a consequence of ideology (Morel, 2023), the 178 most influential articles[^28] on gender and mathematics education only contain ten that explicitly

[^28]: I make the claim that these artifacts represent the “most influential” journal articles on the topic of gender and mathematics education based on the criteria that they are (1) a subset of the top results from an electronic library.
mention ideology; moreover, seven of the ten were written in the last six years. This is, in itself, a significant ideological revelation. Thus, this study will analyze and critique—from the position of Lacanian political psychoanalysis—the ideologies presented and suggested in the existing literature on gender and mathematics education over the past fifty years and will show how these ideologies reveal what the unconscious purposes and goals of gender research in mathematics education might be. In doing so, I will begin to answer the following general research question, which I further develop and refine into a specific research question in Chapter II: *What is it about mathematics that causes it to be such a potent social force in structuring gender, social, and economic relations?* 

---

29 This can be considered a finding of the present study. It was determined by doing a word search on all of the artifacts. I discuss this finding more in Chapters IV and V. It can be considered an “overall characterization” of the artifacts. I have briefly mentioned it here to more fully frame the motivation of the present study.

30 Note that, as I have explained, I am not performing a discourse analysis in the present study, rather, I am performing a psychoanalytic ideology critique of quilted-speeches. For this reason, I do not put any “empirical weight” on this proportion of artifacts that mention ideology. Rather I utilize this proportion as an indication that ideology has been generally ignored (as evidenced in the quilted-speeches of the artifacts) in the production of gender research in the field of mathematics education.
CHAPTER II

THE SPEECH OF THE ARTIFACTS IN FIVE EPOCHS
II The Speech of the Artifacts in Five Epochs

In this chapter, I survey and summarize the artifacts being analyzed in the present study. This chapter is presented as a quilted-speech that aims to be a semblance of the discourse of the artifacts themselves. I do this in order to establish the quilted-speech which the artifacts speak, that is to say, the quilted-speeches of the ideologies I critique in Chapter IV. I present this chapter as an exercise in “closed” writing, that is, writing as if there is no ideology.  

For Lacan, however, there is only “open” writing. After describing the methodological and theoretical perspectives I take in the present study in Chapter III, I then present my analysis in Chapter IV as “open” writing employing speculative logic. Rhetorically, this presents the speech of the artifacts (this chapter) in relief against the psychoanalytic speech I offer (Chapters I, IV, and V). Before proceeding, I outline the selection methods for the artifacts.

1 Selection of the Artifacts

The artifacts analyzed in this study were obtained by performing an electronic library search at a large, public research university in the southeastern United States. The initial search was limited by KEYWORDS: (Gender) AND (Mathematics Education). Search results were limited to peer-reviewed, globally-indexed academic journals only—and only English-language publications since the year 1970. Several thousand results were returned. Based on how the electronic library system ranks results (i.e., keyword relevance, access frequency, and journal ranking), I interpreted the search results as front-loading the most relevant results, with relevance

31 With the exception of ten artifacts (seven of which were written within the last five years), none of the artifacts explicitly considered ideology, which I interpret as taking the most ideological position, namely, that there is no ideology. Thus, in Chapter II, I summarize each of the artifacts with explicit reference to their “discourse” instead of “speech.” I do this in order to present the quilted-speech of the artifacts from the ideological position they seem to generally take, namely, that there is no ideology influencing their discourse. Of course, as an ideological critic, I know this is false, which I will reveal in Chapters IV and V, showing how the quilted-speech of the artifacts reflects fetishistic disavowal, amongst other unconscious influences.

32 “Sex” was also included automatically by the electronic library system. I describe, later in this chapter, how these terms conflate in certain instances, and how this conflated use changed over time.
descending. Thousands of results were unmanageable for the present study, so I began by screening results for relevance by manually accessing and reading abstracts. Once abstracts were manually screened, the article was included if its primary focus was on gender and mathematics education, regardless of methodology or study context employed in the article. In cases where gender was one of several sociocultural dimensions studied (e.g., if a study considered both race and gender), the article was included if I designated that at least half of the analysis of the article was concerned with gender. As expected, this process yielded inclusion results heavily at first (with almost all search results being included by the criteria), with the frequency of inclusion results tapering off over time. After the 500th article had been manually screened, almost all results began being excluded. At the 600th article, I was satisfied that few if any articles would continue to be returned further. For example, after the 400th article, many of the new included results were duplicates of articles already captured in the first 400 results. It is possible that I missed potential artifacts through this method, but any possible impact those potentially missed articles may have had on this study were considered to be minor. Overall, this process returned 178 artifacts that were included in the yield. These artifacts were generally scanned to ensure that: (1) all major mathematics education journals had been captured by the search, and (2) articles captured in the yield at least contained all of the foundational articles on the topic of gender and mathematics education known to me, and indeed they had. After reading the full text version of the retained 178 articles, I considered the impact factors of their respective publication outlets, the qualitative frequency with which included articles cited each other, and the number of overall citations of each included result. Qualitatively, this overall synopsis of the yielded articles convinced me that, notwithstanding potential outliers not captured in the yield, that a yield of 178 articles was large enough (considering the publication outlets’ reputations) that the
included articles provided a sufficiently accurate picture of the development of gender research in mathematics education since 1970.

2 Prefatory Note

In 1970, with the founding of the Journal for Research in Mathematics Education and Educational Studies in Mathematics, mathematics education was established as a distinct academic field. Only seven years later, Fennema and Sherman (1977) published the first major research article—a quantitative study—on a study of sex differences between girls and boys in terms of achievement in mathematics. These researchers’ concluding sentences in the article rocked the world of mathematics education, then a fledgling field. Since then, those concluding sentences have become legendary in the field:

This study suggests that long accepted beliefs about the validity and importance of “sex differences” need re-examination in a variety of ways. These data certainly indicate that many females have as much mathematical potential as do many males. The generalized belief that females cannot do well in mathematics is not supported. (Fennema & Sherman, 1977, p. 69, my emphasis)

Since then, gender and sex have become a crucial research focus for mathematics education researchers, as reaffirmed by the NCTM’s (2014) Principles to Actions. It is thus clear that gender and “sex” represent a fundamental quandary in mathematics education.

Notwithstanding this continued focus on the matter, “gender and mathematics” research has proceeded in increasingly incommensurable ways since the 1970s—reading the literature as a whole nearly comes across as “these researchers all seem to be talking about something

---

33 There is additionally a small subfield of “sexuality” research in mathematics education, that primarily focuses on issues of sexual identity. These contributions are not included in the present text, except in cases where gender is conceptualized in relation to sexuality. In cases where I use the term “gender and ‘sex’,” I specifically mean cases where researchers are conflating the terms.
different” (see also Damarin & Erchick, 2010). The last fifty years has thus ushered forth various approaches consisting of biological, psychological, sociocultural, and critical frames. Biological arguments generally advance a scientific ideology and attempt to pinpoint the biological nature of sex as being the cause of differential mathematics achievement and performance. Psychological arguments generally advance a scientific or neoliberal ideology and attempt to associate a vague “male/female” binary of identity with measurable behavioral traits such as attitude and confidence in mathematics. Sociocultural arguments also generally advance a neoliberal ideology and attempt to identify avenues of gender socialization as the cause for the ways in which males and females relate to mathematics in school and society. Critical arguments generally advance a postmodern ideology and apply critical theory concepts to local analyses of gender and mathematics to theorize polemics in favor of exposing contextually specific oppression in experiences of school and achievement.

In my view, these approaches fixate on some aspect of the myth of stable identity, as is compulsory under capitalism (this is a well-known argument in political psychoanalysis; e.g., Lacan, 1962/n.d.-a; Thrul, 2022) and thus implicate the dominant mode of education: that of the capitalist mode of school (the success/failure dichotomy of the school credit system; see Vinner, 1997). My rationale for this claim is rooted in Lacanian psychoanalysis: that “gender” is a self-representational sinthome (Gherovici, 2017) that expresses the psyche’s relationship to the Formulas of Sexuation, and that the capitalist imperative of “identity” codifies allegiance to an inexistent stabilizing technology: the technology of gender (Atanasoski & Vora, 2019). From

---

34 For example, “I think I am [stable identity signifier], therefore I am [stable identity signifier].”

35 As I have written elsewhere (Moore, 2022), “[A]ffirming the unconscious uses of gender as a technology to structure reality through the impressibility of living bodies would… foreclose the entire ideology of capitalism and would irreversibly reveal the sentimentality that polices the impressible bodies on which capitalism acts” (p. 18).
this view, gender is unable to be investigated or even accurately theorized from other perspectives. Thus, I make no attempt to reconcile my approach to other approaches, but rather to show how—through a Lacanian critique of ideology—gender and mathematics may be radically envisioned.

To start, I performed an extensive literature review and identified several ideological threads that describe a quilted speech of gender and mathematics that has been advanced over the past fifty years. Through a surveyal of artifacts identified for this study, I identified several ideological threads that appear to be evidenced. The purpose of this dissertation is to critique those ideologies from the perspective of the Lacanian ideology.

When comparing the Fennema and Sherman (1977) study to modern gender research in the field, it is clear that much has been investigated, much has been learned, and an increasing number of new questions have also emerged. As a result, gender research in mathematics education has become a dynamic, changing, and perplexing topic for scholars to approach. One result of this dynamism has been the advent of gender being presented in the literature through an intersection with some other focus (e.g., affect, culturally relevant pedagogy). These intersections lead to an increasingly large net as to what “gender research” in mathematics education is. It would thus be impossible to cover every aspect of gender research within this expanding net of other topics, so in order to keep the focus of the present text, I restrict my survey to research that takes gender as its primary focus, rather than being a peripheral focus through another topical intersection. However, as identity is a crucial component of the very concept of gender, several foundational articles on the intersection of “gender” and “identity” as research foci have been included. Race could also be formulated within this inclusion criteria, and thus research on the intersection of race and gender (e.g., Black women) is included in cases
where gender is sufficiently explicated as important to the findings by the authors of such analyses. In addition, I only include research specific to mathematics education and eschew the plethora of research on gender in other educational fields.\textsuperscript{36}

The goal of the dissertation is not to survey the literature, but to critique the ideological threads that have produced the corpus. Thus, I do not systematically review the literature in question, but rather look to exemplars within the corpus to point out how an ideology has produced its claims. This ideology critique does not perform fine-grained analysis on specific articles, but rather shows how major ideological threads have coalesced in the form of these 178 articles \textit{qua} ideological artifacts. In most articles, multiple ideologies were present, which I describe in Chapter IV.

3 \textbf{The First Epoch: Biology, Sex-Typing, and Disconcert}

The first epoch of gender research in mathematics education can be characterized by a privileging of ideologies relating to biological and sex-typed arguments (e.g., Benbow & Stanley, 1980), and the first occurrences of other researchers who expressed disconcert with these approaches (e.g., Fennema & Sherman, 1977). In this section, I outline the development of the literature during this period, which corresponds to the genesis of the field of mathematics education in its own right (i.e., with the founding of the \textit{Journal for Research in Mathematics Education, JRME, and Educational Studies in Mathematics, ESM}).

Beginning at the beginning, Fennema (1974) brought forth the issue of “the sexes” in mathematics education by publishing a review of previous literature on the matter in the \textit{JRME}. She noted that before 1960, the issue was approached from only psychological angles. During

\textsuperscript{36} Notwithstanding their contribution to the psychological literature, I have not rooted my analysis of psychologically-based articles in the foundational text of Maccoby and Jacklin (1974), although it was cited as the theoretical perspective by many early papers. This decision was made to constrain the scope of the present text due to its length.
the 1960s, those psychologists shifted to including some educational theory. And finally, in the early 1970s, mathematics educators started to formulate original questions and perspectives on the issues that were unique to the field. She broke down all of this previous work into the age of children studied, so that studies could be more appropriately aligned with each other. In studies related to pre-school children, most studies found no sex differences, and one study found that girls performed significantly better in mathematics. In studies related to elementary-aged children, a few studies showed either girls or boys outperforming each other in various cases, but the majority of studies again showed no differences in achievement. Next, in the case of older children (roughly grades 5–9), studies started to show more varying results, yet overall her analysis showed that there were no consistent differences across the studies, and that inter-study differences were mainly caused by the various studies measuring different parts of mathematics learning as it related to the sexes: but, she noted that, “if a difference does exist” (Fennema, 1974, p. 135), that it appeared that girls at this age level did better with computation and boys did better with mathematical reasoning.

Then, in the case of high school students, results started to diverge with sharply varying conclusions, and that new foci such as course dropout and social factors were added due to their relevance at the high school level. For example, lower-achieving boys tended to drop out of mathematics courses more often, leaving the male samples more homogenous, whereas more girls never elect to take many math courses to start with (including those who might be called “high-ability girls”). Notwithstanding these factors, she notes that these studies on high school students again lead to contradictory results, with one study favoring boys, one favoring girls, and one favoring neither. As a result of all of these studies, Fennema concludes that it should be quite
obvious to the field that “gender” (or “sex differences”) clearly constitute a complex problem that researchers do not yet sufficiently understand nor have yet theorized.

Regarding computation strategies amongst young children, Carr and Jessup (1997) found years later that elementary aged girls were more likely to count on their fingers whereas boys were more likely to recall from memory when performing computation. They theorized that this could be a reason why the girls are more likely to be successful in computation at the elementary level. Carr and Jessup would later (Carr et al., 1999) study and find that this strategy difference (with boys using mental strategies and girls using finger-counting strategies) was related to gendered beliefs about ability and the ways that teachers and parents promoted strategies as being reflective of ability: “Girls’ strategy use was [found to be] not related to perceived adult beliefs or actions” (Carr et al., 1999, p. 20). In the Danish context, Sunde and colleagues (2020) found similar results at the same age, that girls used counting significantly more (and mental strategies significantly less) than boys when performing single-digit addition. Similarly, Rivers and colleagues (2021) also found that first grade boys were more precise in numeracy estimations on the number line, and that girls were significantly less confident in their estimations.

With the thrust put forth by Fennema (1974) as their motivation, Fennema and Sherman (1976) were the first to offer an explicit tool, what they called an attitude scale, for investigating sex differences in mathematics. At this time, “sex” meant gender, and it was conceived of as a rigid binary with biological origins, rather than a dynamic dimension with psychological origins. In this paper, they present their attitude measure that consisted of various subscales to capture various theorized dimensions of the relationship between sex, attitude, and mathematics. These subscales included: (1) Attitude Towards Success in Mathematics; (2) Mathematics as a Male
Domain; (3) and (4) Mother/Father; (5) Teacher Scale; (6) Confidence in Learning Mathematics; (7) Mathematics Anxiety; (8) Effectance Motivation in Mathematics; and (9) Mathematics Usefulness. By capturing these nine dimensions of this theorized relationship, they propose that they can be combined in any way to fit the specific needs of a researcher. They validated the instruments with a large study ($N = 1,600$) of high school students.

Following the publication and validation of these instruments, the same authors proceeded to publish three articles reporting on large study results using the instruments (Fennema & Sherman, 1977, 1978; Sherman & Fennema, 1977). The first of these (Fennema & Sherman, 1977) reported evidence that socio-cultural factors were crucial to studying “sex differences.” At the time that this study came out, it was popularly believed that females had biologically less aptitude for mathematics than did males. This study was the first to show that this belief was flawed. They showed that socio-cultural factors such as student background and previous experience in mathematics (i.e., quality of prior mathematics instruction, opportunities to take mathematics, and so forth) were the cause of observed “sex differences” in mathematics, and that, when controlled for, sex differences were “not more pronounced with age and more difficult material” (Fennema & Sherman, 1977, p. 65, my emphasis). Without controlling for this, sex differences in mathematics were explained through other socio-cultural (e.g., affective) factors. In fact, when these socio-cultural factors were controlled for with respect to performance in spatial visualization skills, sex differences became suspiciously small which led the authors to suggest that most sex-related differences should become suspect to the education research field. They claimed that:

While it is possible to show differences in mathematics achievement or aptitude between groups of males and females unequal in mathematical background, reporting such
findings as “sex differences” in mathematics “aptitude” erroneously implies that these differences are [differences] in inherent ability and can be attributed to sex per se.

(Fennema & Sherman, 1977, p. 66)

Moreover, the variation of results between different schools in the study “make it less likely that the differences observed can be attributed to sex per se” (p. 66). These differences, rather than being rooted in sex difference, were more likely related to socio-cultural differences between schools. The next factor they cited was confidence, with males being more confident in mathematics overall. However, because the issue of confidence precedes any performance achievement (i.e., in very young children), it is unlikely that achievement differences led to females’ decreased confidence. Rather, a more likely cause is the socio-cultural factor of stereotype threat and stereotyping. For example, females’ originally lesser confidence more often led to them not pursuing mathematics courses as extensively or over as much time as males, which will obviously lead to lower scores on achievement tests for females. This was later supported by a study by Spencer and colleagues (1999), who found that simply describing a testing instrument to examinees as characteristically producing gender differences led to women’s much worse performance on it; by comparison, their control group where they told participants that the instrument had not produced gender differences in the past nearly eliminated gender differences between female and male examinees.

The third factor they cited is the perception that mathematics is a male domain: in the study results, males stereotyped mathematics more than females, although they did not self-identify it as a “male” domain. Rather, the authors suggest that males more often stereotype the

---

37 This was later confirmed by Dahlbom and colleagues (2011), who found that boys overestimated their confidence about their grades on an upcoming mathematics test, whereas girls underestimated their confidence on the test.
domain of mathematics in terms of their own perceived confidence or perceived usefulness of mathematics. Years later, Norton and Rennie (1998) found similar evidence, that boys identified mathematics as a male domain far more than did girls, and that this was one of the most important factors—in combination with boys’ overall more positive attitudes towards mathematics—in typing mathematics as gendered, since no other achievement differences were found in their study.

The fourth factor was the relationship of attitude to socioeconomic class: in poorer schools, girls were more positive in their attitudes towards mathematics, which the authors attributed to being a fear of success, in that girls in richer schools were more likely to be afraid of the risks associated with attempting to be successful in mathematics. In other words, in richer schools, boys had more positive attitudes towards mathematics than girls; in poorer schools, the opposite was the case. This result comports with other literature on the sex-appropriateness of academics changing along lines of social class: in poorer settings, academics are sex-typed as female whereas labor is sex-typed as male; in richer settings, academics are sex-typed as male and labor is sex-typed as female. Years later, Lamb (1996) found the opposite effect of social class on gender—richer girls tended to be more likely than poorer girls in choosing advanced mathematics courses in high school, concluding that “social class compensates for gender” (Lamb, 1996, p. 237). Moreover, Pomeroy (2021) later found that richer boys saw mathematics and physical fitness (both typically seen as masculine domains) as compatible forms of masculinity, but that poorer boys did not—the latter identified with physical fitness and other physical labor as masculine but not mathematics.

The fifth factor was the relationship between boys and girls, their mothers and fathers, and their teachers. In general, “boys perceived more positive attitudes about themselves as
learners of mathematics from their mothers (3 [out of 4] schools), and fathers (2 [out of 4] schools), but not as strongly and consistently from their teachers” (Fennema & Sherman, 1977, p. 68). The results from this subscale showed two important takeaways: on the one hand, the role of the father in sex-typing in general, and particularly in the case of the father’s relationship with daughters, was shown to be significant in how boys and girls perceived the sex-typing of the domain of mathematics; on the other hand, mathematics achievement for both boys and girls was higher with a higher perception of mother’s care, indicating the importance of the role of the mother in academic pursuits for their children. In other words, the father plays an important role in determining for the child how domains are sex-typed, and the mother plays an important role in developing children’s self-concept related to mathematics. Campbell and Beaudry (1998) found similar effects of mothers, particularly that mothers’ education level played an important indirect role in their children’s achievement in mathematics. Similar results were also found by Muller, whose analysis of a large longitudinal dataset found that gender gaps in 8th and 10th grade achievement tests were only found when parents’ involvement was controlled for; however, she also found that parents’ involvement decreased over the high school years, to the point that it has “essentially no relationship to the gains in achievement made by [high school] seniors” (Muller, 1998, p. 336).

The last factor was interest in problem-solving. At the time, it was believed that females were less interested in problem-solving than males, and this led to poorer mathematics performance. The results of this study (Fennema & Sherman, 1977), however, showed no difference in interest in problem-solving, thus debunking this belief. Overall, the results of this first study only showed some of the sex-related differences in half of the studied schools, and since the schools were relatively culturally homogenous (being all American public schools),
these sex differences were likely not related to genetic or biological origins (i.e., the gene pool argument)—hence, other psychological and/or social factors must be responsible.

The second of these studies (Sherman & Fennema, 1977) reported on “related variables” to the first study, such as male and female students’ choices to study mathematics. When separated into two achievement levels (high-achieving and low-achieving), there were more males enrolled in both the high- and low- groups in one year, and more males enrolled in the low- group in another year. Moreover, the data showed that more of these males also planned to continue taking mathematics courses in the future. The authors noted that these differences were not rooted in sex, but rather worked against the commonly held belief that males have a higher aptitude than females for mathematics; in fact, when differences were controlled for, males and females showed the same cognitive mathematical abilities, and moreover were not significantly different for attitudes towards mathematics.

In this second of their studies, females’ interest in problem-solving was actually higher in this study, and, when controlling for intent to enroll in courses, attitudes towards success in mathematics was the same for both males and females. The only exception to the breaks that these results made from commonly held beliefs was that males did more often consider mathematics to be a male domain. Overall, the results showed that mathematical confidence, mother/father attitudes and roles in sex-typing of mathematics and academics, perceived usefulness of mathematics, interest in problem-solving, and attitudes towards success were more important in explaining “sex differences” in mathematics than cognitive ability. They suggest that if researchers are interested in studying cognitive-based sex differences, then these affective factors must be controlled for. They conclude the paper by saying that “sex roles” are probably more important to study than “sex differences,” again giving credence to their earlier call that
social and psychological factors are just as important (and probably more important) than biology in studying “sex differences” in mathematics.

The final of these three studies (Fennema & Sherman, 1978) reported on another follow-up study to the previous two, where the focus now was on age and mathematics level. Younger girls and younger boys saw mathematics as equally useful, had the same level of positive attitude, and girls were equally as willing as boys to strive for success in mathematics. “Sex differences” started appearing as early as 6th grade, however, with confidence and sex-typing being the first reasons to emerge as to why. Girls began to feel less confident in math, and boys began to overly sex-type mathematics as male, although both boys and girls admitted sex-typed opinions about mathematics at this grade level. Further differential experiences continued into high school, where differences began to be more severe, such as girls’ increasingly negative opinions about the usefulness of mathematics. This negative trend in girls’ attitudes was compounded especially by perceived “less favorable attitudes” for them to continue to strive to be successful by teachers and parents (particularly their fathers).38

Overall, this third study added more weight to the confirmation that, when socio-cultural factors are controlled for, “sex-related mathematics and other cognitive differences were few and of slight extent. [Further, the] differences did not increase with more complex levels of mathematics, nor did girls show themselves to be any less interested in mathematics [or problem-solving] than boys” (Fennema & Sherman, 1978, pp. 201–202). The importance of these three studies’ results cannot be overstated, because they marked a radical departure from many popularly held social beliefs (that, at the time, were still being actively advanced by researchers)

38 McCoy and colleagues (2022) later studied a similar line of inquiry, and found that mothers of Irish children held gendered stereotypes as well, which, in their analysis, led to the mothers’ underestimating girls’ math achievements and overestimating boys’.
about gender and mathematics at the time. In a way, these three studies “set the stage” for all future research on gender in mathematics education, so, appropriately, I have intentionally laid out their results carefully as the genesis of the research on which the present text focuses. As the reader will see in what follows, several “themes” emerged in subsequent research each of which privileges certain aspects of the relationship between gender and mathematics.

A stark demarcation occurred next, with Benbow and Stanley (1980) studying a large sample of “gifted” middle school students which they recruited through “talent searches.” These searches qualified the sample participants equally between girls and boys, so that the final sample should represent students with “essentially identical formal educational experiences” (Benbow & Stanley, 1980, p. 1262). Writing from a psychological perspective, they claimed that within the gifted population of students they surveyed, any differential course-taking trends (as hypothesized by Fennema and Sherman as one of the non-biological factors of importance) would be controlled for. Their data showed a sex difference in mathematical ability (in the form of higher test scores) favoring boys across the entire sample, and they also found that this increased over time in high school. They conclude that sex differences in mathematical reasoning ability (with boys having higher ability than girls) led to boys getting higher test scores and also led to their likelihood to enroll in more mathematics classes. This difference in mathematical reasoning, according to their data, begins in the 7th grade. They do not attribute this to differences in prior mathematics experiences, assuming that experiences in prior grades are homogenous between the sexes. They claim that it would be difficult to fully suss out the relationship between social factors related to gender and mathematics reasoning ability, instead suggesting that societal factors are more likely related to mathematics achievement than ability. However, to bolster this claim, they conclude by saying, “We favor the hypothesis that sex differences in
achievement in and attitude toward mathematics result from superior male mathematical ability” (Benbow & Stanley, 1980, p. 1264).

The next year, also in the *JRME*, Becker (1981) presented a study on the differential treatment of males and females in high school mathematics classes by their teachers. Their sample of ten teachers taught classes that were, overall, split evenly between male and female students in number. They quantitatively looked for sex differences regarding directed and non-directed questioning (i.e., calling on a student by name or addressing a question to the entire class), process and product questioning (i.e., higher-order or lower-order questions), “call-outs” (i.e., after addressing a question to the entire class and a particular student answering, the teacher then engages with that student’s answer), and interactions initiated by students. In addition, they qualitatively looked for sex differences with regard to two occurrences: actions and interactions, and the learning environment. Their study found that gender stereotyping was occurring in the classes, with only one observed instance of a non-traditional gender role, which they noted was likely caused by the over-representation of males as mathematics teachers in the sample. The study concluded that due to the sex-typing (as male) of the domain of mathematics, the male students benefitted from “more formal and informal reward[s] and support[es]” as well as “more outlets for classroom academic achievement and recognition” (Becker, 1981, p. 50). Meanwhile, the females were generally treated with “benign neglect” (Becker, 1981, p. 50), in that “nothing was discerned [during the observations] … that could be considered as working in a positive way to stimulate young women to continue their study in mathematics” (Becker, 1981, p. 51). The causes of this differential treatment was, Becker concluded, based on sex-typed societal expectations as well as ability-related expectations in mathematics; because of these expectations, the teachers taught in such a way that benefitted the men whilst (benignly) not
extending the same benefits to the women. Manning (1998) later performed a meta-analysis that found results in support of this line of argumentation.

Benbow and Stanley (1983) then published a follow-up study to their earlier 1980 paper, which reported “more facts” in support of the first paper. Their intention was to add credence to the difference between innate ability and societal factors related to sex. This study took the “high” end of the spectrum of the data (in terms of math achievement) from the earlier study and investigated sex differences within that highest section of the larger data set. They found that, simply by proportion of representation, “boys outnumbered girls 13 to 1” in the highest of mathematical ability groups. This representation was taken to mean that mathematical ability is sex-related, and that it starts to biologically appear around age 13, although they noted that “reasons for this sex difference are unclear” (Benbow & Stanley, 1983, p. 1031). They also noted that, since the sample for this follow-up study only considered the highest sector of mathematics achievers, that it was not possible to generalize the results to particular individuals, but that it indicated a biological distribution of mathematics ability that was significantly more present in males.

At this point in the development of gender research in mathematics education, there appeared to be a bifurcation of “hypotheses” as to the causes of observed sex differences: (1) biology and ability related, and (2) social factors such as differential coursework and sex-typing.

Pallas and Alexander (1983) advanced the latter in a rebut to Benbow and Stanley’s work (which advanced the former). To counter Benbow and Stanley’s admittedly biased sample of the gifted youth, Pallas and Alexander took a more broadly representative sample of high school students to investigate whether differences in coursework were related to sex differences on SAT achievement (the same qualifier that Benbow and Stanley had used for selecting their gifted
students). They found that sex differences in SAT mathematics scores “[shrink] significantly” when controlling for students’ mathematics coursework in high school. As a result of this finding, they are able to conclude that “increasing females’ rates of enrollment in high level mathematics courses would greatly reduce the sex difference in [mathematics SAT achievement] … and that it is premature to reject socialization and experiential explanations for the male-female gap [in mathematics scores]” (Pallas & Alexander, 1983, p. 165). They posit that these socialization differences begin in the elementary grades or at the latest by middle school, so that by high school, “differences in [mathematics] performance emerge [over the time span of high school]” (Pallas & Alexander, 1983, p. 180). However, they note that such socialization factors are complex and that more research is needed to theorize and investigate them more fully.

Years later, Leahey and Guo (2001) would take up this call in another study, finding that while boys and girls start out roughly equally in achievement in elementary school, boys “have a faster rate of acceleration… [so that by] 12th grade, this results in a slight gender difference, which is most pronounced in geometry” (p. 713). This result led Leahey and Guo to add qualifiers to Benbow and Stanley’s earlier arguments by “limit[ing] the extensiveness of their application” (Leahey & Guo, 2001, p. 729), and thus calling for caution when making broad sweeping statements about gendered achievement in mathematics that do not reflect life course development and socialization factors. Instead, Leahey and Guo challenge researchers to study gender differences in “mathematical trajectories” over the lifespan of students. Additionally, Brown and colleagues (2008) later found a weak relationship between gender and intention to continue taking mathematics courses in high schoolers, with the advantage being on the side of males. The females mostly felt that mathematics was too difficult, and most frequently cited this as the reason for their lack of intention in furthering their mathematics coursework. Years later,
Beekman and Ober (2015) found similar results, that when sociocultural factors were controlled for, girls were performing at the same level as boys and possessed all the required abilities for pursuing a STEM career in college and beyond. Without considering or controlling for sociocultural variables, girls ended up underperforming on tests over the years of K-12 school, likely leading to underrepresentation in STEM careers.

Also in keeping with this line of inquiry, Cunningham (2016) found that, amongst Canadian 9th graders entering high school, boys had higher test grades (but with far more variability than girls, so they also occupied the bottom of the distribution as well), but that girls were 1.5 times more likely to enroll in more mathematics courses in high school. Regarding course enrollment in the Australian context, Sikora and Pitt (2019) found that enrollment decisions throughout high school were more dependent on previous course grades than gender, and that notwithstanding this, girls experienced “greater improvement than boys in Year 12 for all levels of mathematics except the most advanced course [offered in the national curriculum]” (Sikora & Pitt, 2019, p. 197).

The same year as Pallas and Alexander’s report, Beckwith (1983) also contributed a significant rebuttal to Benbow and Stanley’s work. He analyzed Benbow and Stanley’s work with respect to the assumptions on which it was based, claiming that any researchers who “suggest that detecting a biological basis for a particular human ability indicates the unchangeable nature of that ability are committing the fallacy of biological determinism” (Beckwith, 1983, p. 158). He criticizes the (often unstated) assumption that socialization factors are irrelevant to the development of mathematics performance differences, especially those that cannot be quantified. By contextualizing the appearance of the “biology argument” within the women’s movement that began in the mid-1960s, he criticizes researchers who attribute “a test
score to a physical meaning” (Beckwith, 1983, p. 158). Thus, Beckwith offers one of the first philosophical arguments against certain scientific ideologies in the study of human mathematical behavior. He traces the historical development of such ideologies and their relationship to education back in the 19th century, which have included arguments such as skull size by race and sex, economic class structure, and genetics—all of which had, at their respective points in history, appeared in major academic outlets. These arguments, according to Beckwith (1983), all:

(1) privilege the assumption that biology is a basis for “socially observed difference”; (2) privilege the assumption that biologically-rooted differences are unchangeable; (3) assign physical attributes to “socially constructed trait[s]”; (4) privilege the assumption that “dominant sectors of society (male or white) are superior”; (5) “come at times in history when society is convulsed over questions of sex or race”; and (6) are “scientifically invalid” (p. 159). Overall, he rebukes gender research such as Benbow and Stanley’s for being reductionist, and that, in so being reductionist, they ignore the complexity of “social and cultural evolution” (Beckwith, 1983, p. 160) in favor of determinism. Finally, he claims that such research, despite being flawed, still creates large effects in society regarding beliefs and attitudes about mathematics ability and gender.39

However, researchers were not done with analyzing the effects of studies such as Benbow and Stanley advance. Two years later, Jacobs and Eccles (1985) studied the impacts of media reports on the Benbow and Stanley (1980) study on parents’ attitudes towards their children’s mathematics performance. They found that the media rarely covered research results on education topics, but that when they did, that they did have impacts on parents’ beliefs and

---

39 Ross and colleagues (2012) later found evidence in support of this: they analyzed data from 1,000 middle schoolers in Canada, and found that mathematics achievement was equal between males and females, despite males having a benefit in terms of self-efficacy beliefs. Using a structural equation model, they found that beliefs about achievement were gendered.
attitudes. In particular, they investigate parents’ beliefs about (1) “the mathematical ability of their own children,” and (2) “general stereotypes about sex differences in mathematical ability” (Jacobs & Eccles, 1985, p. 21).

To perform the study, they used Likert-type items and open-ended questions in a questionnaire that was sent to parents in Michigan, where the authors were based. The questionnaire was mailed in two parts: before the Benbow and Stanley (1980) study achieved media coverage (which included such popular outlets as Time and Family Weekly magazines), and then roughly three months after the media coverage was achieved. The questionnaire also asked respondents whether or not they had been exposed to media coverage about the study, so that data could be analyzed for the presence or absence of media exposure on the part of the parents. “Exposed” means that the parent had consumed media coverage about the study and “unexposed” means they had not. They found that the exposed fathers had views that became more similar to each other, whereas exposed mothers had views that became more differentiated, meaning that “exposed mothers of girls became more conscious of sex differences… and exposed fathers became more egalitarian” (Jacobs & Eccles, 1985, p. 22). Notably, the exposed mothers reported overall that “[b]oys have a tendency to understand the principles (of math) but girls are trying to just memorize the principles” (Jacobs & Eccles, 1985, p. 22). When asked about their future performance expectations of their children in mathematics, exposed mothers responded about the same as unexposed mothers, and did not have different views based on their children’s sex. However, exposed fathers did change more when compared to unexposed fathers and this difference was statistically significant: the exposed fathers believed that their children—both boys and girls—would fare better in future mathematics courses as a result of their exposure, when compared to the unexposed fathers. In other words, the exposed fathers took the
media coverage as a charge to increase the importance they put in their parenting on their children’s success in mathematics: for the fathers of boys, this did not change (unexposed fathers of boys already placed importance on mathematics success), but for the fathers of girls, the media exposure caused a significant increase in the importance they placed on their daughters’ future success in mathematics.

Moreover, the questionnaire data revealed parentally-held gender stereotypes. Both exposed and unexposed mothers believed mathematics was more important for males than females, regardless of the sex of their own children. Additionally, all mothers also believed that boys tend to do better in mathematics than females; this did not change along lines of mothers’ exposure nor the sex of their own children. Fathers, on the other hand, also believed that mathematics was more useful for males than females, but fathers of boys also believed that mathematics was more useful “in general” (Jacobs & Eccles, 1985, p. 23). These data, overall, showed that the media impact of the Benbow and Stanley (1980) study did change parents’ beliefs and attitudes, and that these changes overall acted in a way that increased gender stereotypes in parents’ beliefs. The only unexpected result was the “positive” change on fathers of daughters: “these [exposed] fathers came to the defense of their daughters” (Jacobs & Eccles, 1985, p. 24).

### 3.1 Summary of The First Epoch

The First Epoch can be characterized as one that privileged biological arguments as well as the beginnings of the “social factors” hypothesis that expressed disagreement with the former. The biological arguments of the First Epoch generally claim that males biologically possess greater mathematics ability, whereas the social factors hypothesis theorized that observations in “sex differences” in achievement were the result of social and cultural influences. In terms of the
latter, researchers claimed that these social and cultural factors were complex and needed to be further theorized. These arguments generally focused on the dimension of achievement, whether that achievement was evidenced in course enrollment, test scores, or other metrics of success in mathematics. The social factors hypothesis also entered into the discussion the dimensions of familial influence, sex-typing, psychological aspects such as attitudes and beliefs, and some initial theorizing of the role of social class.

4 The Second Epoch: Empirico-Psychology and Complexified Sociology

At this point in the history of gender research in mathematics education, several key parameters had been established, that would end up structuring the rest of the literature I survey next: namely, that gender research is a complex problem, that biological relationships were by themselves insufficient, that social factors are of great importance, that the study of gender in mathematics is (in part) a political issue, and that further theorization was needed. For example, Fennema and Peterson (1985) briefly theorized in an editorial note that the types of mathematical activity students were compelled to engage in, what they called “autonomous learning behaviors,” may work to complexly mediate social genderization factors (e.g., believing that mathematics achievement does not match feminine sex-role identity) and the content-related tasks in front of students in the classroom. In this way, the mid- to late-1980s research agenda would set gender research up as a dedicated and growing subfield of mathematics education. The research surveyed next shows increasing variety in the approaches taken by researchers, as well as—in response to previous results showing the importance of social factors—culturally-situated studies in various countries. This theorization was later supported by a study by Stage and
Kloosterman (1995) that found the same resulting relationships amongst college-level remedial mathematics students.\textsuperscript{40}

Ethington and Wolfle (1986) developed a structural equation model for the relationship between mathematics achievement and sex, attempting to further illuminate the complicated nature of how males and females may experience differences in mathematical development. The variables included in the model are mathematics ability, verbal ability, mathematics attitudes, mathematics exposure, and mathematics achievement—they also noted that these variables were not exhaustive of the differences in experiences between men and women. They used data from a large American longitudinal study on high school sophomores that was roughly divided between 45% men and 55% women. They found that the process of mathematical development and achievement was “not simply additive” (Ethington & Wolfle, 1986, p. 73), but that it was more complex than commonly conceived of by researchers. One such complexity was illustrated by the role of verbal ability: it had a negative influence on both women’s and men’s attitudes towards mathematics, although it was much more negative for women. At the same time, though, verbal ability also contributed positive effects on mathematics achievement for men. In addition, men’s attitudes towards mathematics had a stronger influence on their achievement than for women. They conclude that, overall, the model suggests that “the process of mathematics achievement is more flexible... for men... [and that] questions about... [sex] differences in mathematics achievement have little meaning unless the question is asked in relation to specific values of prior ability and educational [experience]” (Ethington & Wolfle, 1986, p. 73).

\textsuperscript{40}This construct was later developed further by Lubienski and colleagues (2021) into a framework of \textit{bold problem solving}, that included Fennema and Peterson’s notion of \textit{autonomous learning behavior} (already described) and students’ beliefs about mathematics and how it is learned, for example, how to determine what strategy to use on a problem.
Boothroyd and Chapman (1987) performed a study in Liberia to test the impacts of a new pedagogical intervention (called Improved Efficiency of Learning or “programmed teaching”) that was claimed to improve student achievement overall whilst also “minimiz[ing] gender-related achievement differences” (p. 99). They found, when comparing the student achievement of the test group to traditional teaching methods, that the programmed teaching method did produce significantly greater student achievement in both mathematics and English, however the intervention also led to greater gender differences in the achievement of the test group (where boys outperformed girls in both mathematics and English). In the case of mathematics, boys “outperformed girls in [the programmed teaching classes] to a significantly greater degree than was observed in the [traditional teaching classes … and that the] increasing disparity in male-female achievement [amongst the intervention groups overall] was greatest in mathematics” (Boothroyd & Chapman, 1987, p. 104). They concluded that, in light of these results, researchers of any programmed instructional interventions must be aware that such interventions “may increase variation in rates of achievement among subgroups of students” (Boothroyd & Chapman, 1987, p. 105). The increase of gender differences under the intervention is troubling, as it was billed specifically as promising to do the opposite.

Doolittle and Cleary (1987) investigated the question of gender-based differential item performance on assessment instruments. They analyzed data from ACT performance between eight randomly equivalent groups of high schoolers. They controlled for the confounding effects of instructional differences by deleting from the sample students who had not had the requisite coursework. They found that “[g]eometry and mathematics reasoning items were relatively more difficult for female examinees [than for males] and the more algorithmic, computation-oriented

---

41 Also see (Johnson et al., 2020; Moore & Johnson, 2021) for another example of this argument and also the study that motivated the present dissertation.
items were relatively easier [for females]” (Doolittle & Cleary, 1987, p. 157). While they concluded that differential item performance between males and females was “not a simple consequence of differential instruction at the high school level” (Doolittle & Cleary, 1987, p. 164), they also conceded that the cause(s) of this gender-based difference were unclear; so, they decided to theorize some possible explanations. First, they theorized that it may be an issue of item bias in the ACT “unfairly measuring extraneous content” (Doolittle & Cleary, 1987, p. 164), but they noted that this possibility was not particularly useful because the items had been carefully constructed to align with the formal curriculum of the school. Their second theory related to the “social factors” hypothesis advanced by other researchers, namely that gender group differences in instruction or background (e.g., instructional experiences from earlier in childhood may be unfairly facilitative for the men) may have already been so entrenched before students enter high school that controlling for confounding variables only at the high school level was not sufficient, or that a “wide array of sociocultural factors [and attitudes have accumulated] throughout the lives of individuals” (Doolittle & Cleary, 1987, p. 164). Finally, they theorized that, similar to the “biology argument” advanced by other researchers, there “may be real differences between males and females in [the abilities measured by the ACT]” (Doolittle & Cleary, 1987, p. 164), as evidenced in the geometric (i.e., spatial) and axiomatic reasoning questions being easier for the men whilst the computation and procedure-related questions being easier for the women. Bielinski and Davison (1998) found similar results in the SAT data. Geary (1996) later attempted to explain this by way of sex-selection in the types of physical activities that males and females engage in, namely that males engage in activities that employ spatial and geometry knowledge more often than do females. Much later, Kotsopoulos and colleagues

42 Li and colleagues (2003) also found this result.
(2017) would find evidence of this, studying 2-year old toddlers’ visual-spatial skills and finding no differences between males and females. They did however find that the 2-year-old boys who engaged in more visual-spatial activities had higher visual-spatial skills, and they theorized that lack of opportunity for girls to engage in such activities may lead to a gender difference (in favor of boys) later in development.

Hall and Hoff (1988) further investigated the hypothesis that gender differences in mathematics began appearing in middle school. They quantitively studied the Wechsler Intelligence Scale for Children–Revised (WISC-R) results for students in grades 2, 4, and 6 to see when gender differences may start beginning, controlling for intelligence by covarying out the IQ portion of the instrument. The results of their analysis did not support any hypothesis of significant gender differences in mathematics. However, they noted that females had a slight tendency to perform better in 2nd grade, while males tended to perform slightly better in 4th and 6th grades. They interpreted this as support for the “social factors” hypothesis advanced by some previous researchers such as Fennema and Sherman (e.g., 1977), namely, that these social factors were beginning by late elementary school. In particular, when they looked at intra-grade performance, their results suggested three possible explanations: (1) that more advanced skills required of more advanced mathematics as children age may be self-excluding of individual children thus resulting in lower scores; (2) that as students age they may be more reticent to apply their full analytical capabilities in situations of group testing; and (3) that there may be a misalignment between what students learned in mathematics class and the items on the WISC-R.

---

43 At this point in history, we see the field begin to switch to the term “gender” and away from “sex.”
44 This was later confirmed by Lee and colleagues (2011) who found that gender gaps in favor of males became significant at the 3rd grade level, and this result appeared across several cultural or ethnic groups in the ECLS data.
In this way, their study added weight to the hypothesis that the relationship between gender and mathematics is complex.

Reyes and Stanic (1988), taking up a radical impetus based on the call of the “social factors” hypothesis, were the first to suggest an intersectional approach to the issue of gender in mathematics education. They analyzed gender differences when seen through an intersectional lens alongside with race and socioeconomic class, drawing on scholars of the ideological criticism of the capitalist mode of school, who ask: “[W]hy, despite the meritocratic ideology of schooling… [d]o fundamental inequalities in school performance and societal position persist” (Reyes & Stanic, 1988, p. 27)? They criticize two aspects of the status of the field of mathematics education at that time: (1) they claim that mathematics education researchers must “find out more about how societal influences affect schools and the people who live and work in them… [w]hile consider[ing] what schools can and cannot do in dealing with unjust inequalities” (Reyes & Stanic, 1988, p. 29); and (2) they claim that mathematics education researchers must investigate classroom processes more closely, noting that “schools also contribute to group differences in achievement” (Reyes & Stanic, 1988 p. 29). To this end, they offer a model that may be useful for such research pursuits. Their model included teachers’ attitudes, social influences outside of school, the school mathematics curricula, students’ attitudes and achievement-related behavior, and classroom processes. From their critical sociological perspective, they claim that all these factors have a complex relationship with what is called “student achievement.” The purpose of the article was to introduce the model and give theoretical and empirical justification for their inclusion of each of the variables; they did not test it independently.

45 The same year, Crenshaw published her foundational paper establishing intersectionality theory; however, it was not used as a framing for this paper because of the timing.
The same year, Yee and Eccles (1988) presented another study of parents’ attitudes about children’s mathematics achievement, in particular, how parents’ sex-type attribution bias may contribute to their perception about their own children’s mathematics ability. They administered a questionnaire to the parents of 48 students, with items about their own background, and standardized achievement test results and mathematics course grades for their children were also analyzed. They found that the parents’ perceptions and expectations of their children’s mathematics ability were generally in agreement with what the children were actually achieving in school. In other words, they “held higher performance standards for [more able children]” and thought these children would continue to do better in future courses (Yee & Eccles, 1988, p. 327). They also found that mothers tended to credit “more able children with talent and less able children with effort [and the addition of parent help]” (Yee & Eccles, 1988, p. 327). In parallel to this finding, the parents tended to attribute failure to lack of effort by all children—with mothers also adding that the lack of parent and teacher help for less able children also contributed to their failure. Parents overall believed that “lack of talent” was the least important reason that students may fail, regardless of ability level. Regarding the sex of their child, girls’ mothers thought their daughters were less mathematically able than did boys’ mothers, and that as a result of this, their daughters had to work harder than the boys did in mathematics.46

In addition, boys’ mothers attributed talent more highly to mathematics success than did girls’ mothers. Fathers’ beliefs about their children’s ability based on sex were different than the mothers: girls’ fathers thought their daughters were overall doing better in school than did the fathers of boys, but this was also coupled with fathers of boys holding higher expectations for

---

46 Interestingly, Rozek and colleagues (2015) found that when parents gave a motivational intervention to their children about the usefulness and value of success in mathematics courses and continued future enrollment, the impact on the children was most pronounced (leading to more success) in high-achieving daughters and low-achieving sons. These results seem to be in line with the greater variability hypothesis about males.
minimum grades in school for their sons. This led the fathers of boys to being overall more
disappointed with their sons’ academic performance than were the fathers of girls. The data
suggested that fathers “may be more demanding of their sons’ academic performance than of
their daughters” (Yee & Eccles, 1988, p. 329). Fathers generally attributed mathematics failure
to lack of teacher help and excessive task difficulty, for both sons and daughters; in other words,
fathers generally agreed with mothers that effort was far more important than talent in achieving
mathematics success. This study was an interesting contribution to the literature because it
started to show how socialization of gender has hidden dimensions in the parent-child
relationship when it comes to academic achievement in school, and particularly in mathematics.

Bradberry (1989) offered a quantitative study on results of the British GCSE
examinations, looking specifically at gender differences in mathematics scores. He found that, in
general, girls and boys overlapped in their scores to a large degree, but that boys’ scores tended
to have more variability. In the ways that they do vary, he found that boys tended to do better in
spatial or mathematical reasoning problems, and girls tended to do better with procedural
problems: “[Girls] have a greater tendency to show caution, to avoid being wrong and to use
processes with which they feel confident and secure. Boys generally appear to demonstrate
greater flair in restructuring problems and to use the relevant cues in a novel situation”
(Bradberry, 1989, p. 313). These results suggested to Bradberry that the reasons for this
difference are intricate and that it was critical for any education system aimed at “equal
opportunities” to take up this issue with increasing seriousness. In his analysis, “The
expectations of girls and women by society at large determine the extent to which girls
participate and achieve” (Bradberry, 1989, p. 314), thus Bradberry calls for school influences,
social factors, and attitudes to be taken up in any future research on differential gender
performance in mathematics. In the same year, Cheung (1989) found the same results amongst children’s mathematics achievement in Hong Kong, suggesting the boys/spatial/reasoning alignment and the girls/procedural alignment was not occurring in isolated sociocultural contexts. Similarly, Innabi and Dodeen (2017) much later reported the same result, that on the TIMSS, Jordanian middle school boys outperformed girls on “more difficult, unfamiliar, life-related mathematical problems” but that girls outperformed boys on “familiar, less difficult, and not life-related problems” (Innabi & Dodeen, 2018, p. 127).

Doolittle (1989) continued his previous work into differential item functioning on the ACT, by investigating characteristics of items that produced gendered achievement differences. He found, as had others before him, that males tend to do better on “strategic” problems (whether spatial/geometry or reasoning-based) than females, and that this difference was consistent when controlling for course background of students. He also claimed that it is “not readily apparent” why these differences exist, and that more complex social factor/background reasons, biological reasons, or socially-learned reasons may exist. Five years later, Gallagher and de Lisi (1994) produced similar results about the mathematics portion of the SAT, finding a male advantage on what they called “unconventional” problems (reasoning, abstract, etc.), whereas females had the advantage on “conventional” (computational, procedural) problems. Years later, Gallagher (1998) suggested that these differences may be caused by socialization differences for boys and girls that lead to differences in cognitive development, drawing on biosocial theory to predict which types of items (by their item characteristics, such as context, verbality, and mathematical skills) might favor males versus females. Engelhard returned to this question (Garner & Engelhard, 1999) and found somewhat different results, that women on the Georgia version of the Common Core test had an achievement advantage on algebra problems, and that men had an
achievement advantage on Geometry, computation, and proportion problems. However, Garner and Engelhard (1999) also found that the men’s advantage was far more variable, and the women’s advantage on the algebra problems was more consistent. Liu and Wilson (2009) studied the PISA data from 2000–2003 and similarly found that while males performed better on “complex” and “spatial” type problems, there was no measurable differential item functioning on multiple-choice items generally.

Kimball (1989) offered a different and quite new perspective, claiming that classroom performance should be considered a different measure of “achievement” or success than standardized testing, when studying gender differences. She asked the question, why is it that girls tend to achieve better grades in mathematics courses, while boys tend to do better on mathematics standardized tests? She proposes three hypotheses to make an account of this. First, she hypothesized that boys receive more positive mathematics experiences leading them to be more self-efficacious when taking standardized tests. Second, she hypothesizes that autonomous learning behavior (suggested by Fennema & Peterson, 1985) favors boys which in turn better prepares them for standardized tests, while procedural and rote learning favors girls which in turn better prepares them for classroom assessments. Third, she hypothesizes that males and females engage differently in different types of achievement situations, namely novel (i.e., standardized testing, which favors boys) and familiar (i.e., classroom, which favors girls). She examined existing literature to support these claims, and found that they are tenable. Years later, Seegers and Boekaerts (1996) found a similar effect of the testing environment that favored boys, concluding that “boys experience learning situations where they are confronted with a mathematics test in a more positive way than girls do” (p. 215).
Linn and Hyde (1989) reviewed existing literature up to this point and found that, in agreement with other researchers, cognitive and psychosocial factors were minimal when controlled for properly, and that they should be deemphasized by researchers. They suggest that even including such positions as potentially valid through inclusion in psychology college coursework should be questioned, as they can lead to unconscious further investment in such rationales by future psychological researchers. They also claimed that, as a result of their analysis, gender differences are contextual and situational and should be addressed (to ensure women’s equitable achievement) through pedagogical and assessment interventions and innovations, such as learning environments that “encourage expression of ideas from all students, not just the most confident or aggressive” (Linn & Hyde, 1989, p. 26). Third, they claim that the pedagogy of problem solving must be investigated as to whether methods used by mathematics teachers create socially-related gender differences, such as the possibility of females’ initial lower confidence leading to their use of “dysfunctional [problem-solving] strategies” (Linn & Hyde, 1989, p. 26) on reasoning-related problems where girls tend to perform worse. They frame this critique through the emerging athletics literature of the time that showed girls’ abilities in athletics were increasing, thus throwing doubt on the biological argument that males have better spatial reasoning skills than girls.

Engelhard (1990) took up the line of argument about differential item performance, to further investigate how cognitive complexity and content category may be related to gendered differences on test items. He specifically wanted to see if, when controlling for previous mathematics performance and item difficulty, gender differences seen on specific test items were related to cognitive complexity and content category. In addition, he wanted to compare these questions across two cultures: the US and Thailand. He drew on large samples of 13-year-old
students from both countries that were approximately evenly divided as male and female; these students had participated in the Second International Mathematics Study (SIMS). The results of his analysis added support to previous studies’ results that there was a significant relationship between item characteristics and gender. In particular, he found that—in both the US and Thailand—the gender differential favored boys as cognitive complexity of items increase, even with “controlling for previous mathematics performance, item difficulty, and content category” (Engelhard, 1990, p. 22). He also found that—again both in the US and Thailand—item content was related to gender differences on item performance, namely that items favor boys “as the content of the test items move [sic] from arithmetic to algebra and geometry” (Engelhard, 1990, p. 22), aligning with previous research that suggests boys do better with spatial and reasoning tasks whereas girls do better with procedural tasks. Statistically, he elucidated that the differences were overall small, but that they “do appear to be consistent across cultures” (Engelhard, 1990, p. 22).

The same year, Goldstein and colleagues (1990) investigated why gender may be related to spatial ability, as much previous research had suggested. They used data from visual-spatial ability tests on college students in two groups: ones who had “high” SAT scores and ones who had “significantly higher” SAT scores. They found that while males had more correct answers on the visual-spatial test, “their advantage was eliminated when the ratio of correct responses to items attempted was used as the dependent measure” (Goldstein et al., 1990, p. 546, my emphasis). They also found that males performed better when portions of the test were timed (and again only in terms of raw score, not ratio of correct to attempted), but not during untimed portions of the test. These findings add credence to the theory that more nuanced and intentional
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

study design is needed in making blanket claims about gendered spatial ability claims from testing instruments.

Hyde and Fennema, along with several other colleagues (Hyde et al., 1990a, b), meta-analyzed all the previous research on gender and mathematics, and as a result suggested several conclusions and directions for researchers. They were specifically interested in the relationship of mathematical gender differences to attitude and affect. They concluded that, when differences do exist, they are small—nevertheless, females tend to have more negative attitudes towards mathematics achievement, and that significant differences start to appear by high school and continue in college, while they are much smaller or absent from elementary students. They also found that anxiety could not be generalized across different types of samples in the studies they analyzed—with a crucial exception that men tended to sex-type mathematics as a male domain much more than women did. Further, the more that samples were specifically selected (rather than general population samples) for gender research in mathematics, the more exaggerated gender differences became in the results. Overall, they claimed that each step of performing gender research in mathematics (such as sample selection, unit of analysis, and so forth) all could lead to different conclusions about gender differences in achievement or aspirations. This led these researchers to conclude that social factors, yet again, need to be theorized and studied more in relation to this issue, because these social and political factors could be contributing to or interacting with the personally-held attitudes and affective dimensions of students.

Meece and colleagues (1990) developed a structural equation model to predict mathematics anxiety on course enrollment in 7th through 9th graders. They found that anxiety about mathematics was most directly related to self-perceptions about their own ability, performance expectations, and perceived values about mathematics. They also found that anxiety
about mathematics did not have a direct relationship to students’ grades in classes nor their intentions to enroll in future classes. They found that these patterns were similar for both boys and girls. This lent more credence to the social factor hypothesis. Conversely, Campbell and Evans (1997) found the opposite effect, that anxiety amongst 9th grade girls could act as a deterrent for females in enrollment in more advanced courses. At the university level, Brownridge and Halli (1998) found similar results, that mathematics anxiety tended to be “more debilitating for females” than for males (p. 99). In line with these latter two studies’ results, Devine and colleagues (2012) also found that mathematics anxiety and test anxiety was higher for female high school British students (than for men), but that both sexes were performing the same in terms of their mathematics achievement.

Stokes (1990) performed a study that looked at gender among other social factors and cognitive development levels (from a Piagetian perspective), and found that 5- to 7-year-old males and females did not differ in computational nor problem solving ability. Thus, the study suggested that social factors were far more important when studying “gender differences” in mathematics than biological or developmental factors. She hypothesized, in light of the research that shows males eventually outperforming females in mathematics through the high school years, that the “male superiority” typing of mathematics may begin much earlier than previously suspected and that high school performance gains in males is not the result of a developmental or experiential event, but is rather more likely related to long-term gender-typing of mathematics by societal influence—both consciously and unconsciously. Thus, she calls for skepticism in the field about the “male superiority” argument.

Wilson and Boldizar (1990), working from a sociological perspective, investigated the relationship of economic class and gender in the context of higher education. They found that,
amongst college students, future income potential was an important factor in the “gender segregation” of bachelor’s degrees. More crucially, they found that gendered segregation in college was a result of gendered aspirations in high school, which in turn reflected gender segregation in society more broadly. In other words, differences in females’ and males’ aspirations to pursue mathematics for a college degree reflected sex-typing of domains and aspirations of society generally, and that “the social and psychological barriers to women’s mathematics achievement must be addressed” (Wilson & Boldizar, 1990, p. 62) rather than simply positing causes related only to internal factors (such as biology or affect).

Bridgeman and Wendler (1991) again looked at the gender difference insofar as they may predict performance in college mathematics courses. They drew on SAT data and self-report information about high school mathematics coursework and grades, as well as college course enrollment and grades for three different categories of mathematics (algebra, precalculus, and calculus). They found that, within each of the three categories of college courses, women’s course grades were either equal to or slightly higher than men’s course grades. They also found that, notwithstanding, men’s grades on the mathematics portion of the SAT were higher than women’s by at least 0.3 standard deviations.47 In other words, when controlling for course background and enrollment, women achieved grades in college mathematics coursework that were at least equal to that of the men, despite the men’s high school SAT scores being substantially higher. This result was consistent across “a diverse sample of colleges” (Bridgeman & Wendler, 1991, p. 283), generally refuting theories that differential coursework and course placement trends lead to differences in test scores and course grades (that “lower track” students are destined to do worse in mathematics); conversely, this result supports theories that contrast

---

47 Preckel and colleagues (2008) found similar trends amongst a broad sample of K-12 students: that course grades between boys and girls were roughly equivalent, but that boys performed better on mathematical ability tests.
reasoning and computation skills as different skillsets. In addition, it supports Kimball’s (1989) results in that women should expect to be as successful—if not more than—as their male counterparts in intro-level college mathematics courses despite maybe having lower SAT scores in high school.

Felson and Trudeau (1991) worked from a sociological perspective to investigate the “social factors” argument and its relationship to course grades, coursework (e.g., classroom tests), and SAT scores. They found that both boys and girls in high school are equally prepared to take the SAT (in terms of coursework achievement), but boys fare better, as previously reported in other studies. They also found that some previously advanced social factor arguments (i.e., anxiety, parents’ encouragement, “special” fear specifically of mathematics) were insufficient for explaining observed gender differences. The anxiety they observed in the girls in their sample was attributable to general test anxiety and was not specific to mathematics. They join the call of other researchers that “gender socialization processes must be more specific [that is, more theorized, more developed, more investigated] if they are able to explain why boys outperform girls on some tests [e.g., standardized tests] while girls outperform boys on others [e.g., classroom tests]” (Felson & Trudeau, 1991, p. 113).

Stipek and Gralinski (1991) investigated gender differences in the relationship of achievement-related beliefs and emotions to children’s mathematics success and failure. They captured data on approximately 500 students before and after a routine classroom test. They found that girls tended to: (1) rate their ability lower; (2) expect to do worse on future mathematics tasks; (3) attributed success to ability and failure to luck much less than boys did; and (4) attribute their own failure to low ability. In this same vein, girls were (5) less prideful in their successes in mathematics; (6) more likely than boys to hide their low-scoring tests from
friends afterwards; and (7) less likely than boys to have meritocratic beliefs (i.e., that success in mathematics is the result of hard work). These results point to a complex relationship between gender, beliefs, and social interaction—wit...
wise relationships; and (3) in terms of actionable educational change, females particularly need to be helped to overcome “their own self-defeating attitudes” (Ethington, 1992, p. 180). Years later, Marsh and Seeshing Yeung (1998) found the gender gap in attitudes to be declining, despite females continuing to have slightly worse self-concepts in mathematics than in previous years.

Xu and Farrell (1992) were the next to compare gender differences in a different culture—China. They studied standardized test data (an entrance exam for these high schools and then a post-measure of what would be the equivalent of a Common Core test in the U.S.) from a large sample of Chinese 12th graders—two groups from “experimental” schools and two from select high schools for high-achieving students. They found that, similar to American students, there was little to no gender difference on the high school entrance exam, which supports American findings that gender differences only start to appear in middle school but then become much more manifest in high school. On the post-measure data from the high school standardized test, they only found a gender difference in one of the four schools. They note that the only school where a gender difference was found was a “lower level school… on the edge of the city… [where] the population mostly consists of factory workers and girls have more family chores than boys” (Xu & Farrell, 1992, p. 444). The implications of this were unclear based on limitations of the data, however, due to the sociocultural and socioeconomic situation of the school in question as compared to the other three selective schools, it could be interpreted as adding weight to the social factors hypothesis.

Cherian (1993) offered another study of a cultural context different than the U.S.—the Xhosa group in South Africa. Through a two-way analysis of variance, Cherian found that there was a significant relationship between socioeconomic status and gendered achievement on the standardized 7th grade mathematics test (what would be analogous to the SOL in Virginia).
Specifically, Cherian found that amongst poorer children, girls significantly outperformed boys on the test, while amongst middle-class and richer students the opposite was the case: boys significantly outperformed girls. Cherian’s analysis stated that, within the Xhosa cultural context, “In families of low socioeconomic status, boys tend to stay outdoors more than girls and travel long distances in the mountains and valleys of Transkei while herding the cattle… supporting parents in the struggle to live [through this strenuous labor]” (Cherian, 1993, p. 776).

Kaiser-Messmer (1993) reported on a large study of German students that investigated their beliefs and attitudes towards mathematics. She found that gender differences still existed in many affective and subjective areas: interest in mathematics, importance of doing well in mathematics, and willingness to enter mathematics-related careers. She also found that gendered beliefs in these areas had been changing during recent years. Despite these changes, her analysis of the questionnaire results supported the following conclusions: that the 1980s led to girls being more likely to be “open-minded about mathematical ability and gender roles” than boys, but that these changes did not appear to “become established into most girls’ self-images” (Kaiser-Messmer, 1993, p. 228). Rather, girls’ self-images were still “dominated by factors such as lacking self-confidence [in mathematics]” that resulted in their continuing relegation to “‘socially acceptable’ role expectations and increased self-assertiveness in non-mathematical areas” (Kaiser-Messmer, 1993, p. 228). In other words, while girls have taken up the most dramatic evolutions in their own views on gender (when compared to boys), they still are constrained by gendered socialization expectations and—in the domain of school academics—particularly so in mathematics. Thus, girls’ more modern views on gender roles tended to lead to

---

48 The data were collected in 1989 in West Germany.
their increased confidence in areas outside of mathematics, thus leaving mathematics as a primarily male-typed domain despite social advances in more equitable gender-typing generally.

Low and Over (1993) investigated gender differences in word problems that contained irrelevant information and required students to use algebra to solve them. They found that 10th grade girls were less likely than boys to identify irrelevant information as irrelevant, and were more likely to interpret the irrelevant information as being necessary to solving the problem. They also found that 11th grade girls were less likely to successfully solve the word problems with irrelevant information, and were more likely to use the irrelevant information in solution attempts. By comparison, girls and boys both had the same rate of success in solving word problems without any irrelevant information. They theorized that this may be caused by “girls [being] more likely to use a bottom-up strategy and may have sought to relate all components of information they could identity in the problem in a way that would yield a solution” (Low & Over, 1993, p. 337).

Becker and Forsyth (1994) reported an analysis of over 3000 students’ standardized test scores on mathematics and science-related questions between 1978 and 1988. They found that gender differences were manifesting differently at different percentile levels in the test results: namely, that males performed better in the higher percentile ranks, but that females “closed the gap and, in some instances, outperformed males at the lower percentile ranks” (Becker & Forsyth, 1994, p. 407). In other words, in more average or typical students’ scores, there was no gender gap in favor of males on mathematics problems. It was only in the higher-scoring students that a gender difference in favor of males was detected. They interpreted this result as providing support to the hypothesis that males “generally exhibit greater variability in achievement than females… [and that also] examining male and female performance differences
at different ability levels gives a clearer picture of the relationship between the gender of the students and academic achievement than is achieved by merely considering group averages” (Becker & Forsyth, 1994, pp. 414–415). Fan and colleagues (1997) found similar trends in the NELS-88 data, favoring boys, insofar as the higher-end of the score distribution contained more gender differences than the rest of the score distribution.

Blithe and colleagues (1994) studied gender differences in New Zealand. They performed two analyses: one on the national standardized results for high school seniors applying to university admissions (similar to the SAT in the U.S.), and one group of 400 students at a university in first-year courses. They found that amongst K-12 students, consistent gender differences in mathematics achievement in favor of boys persisted over a period of several years. Amongst the university students, they found that gender differences in mathematics were more ambiguous: intro-level mathematics achievement was not always presenting with gender differences, and when differences were present, they sometimes favored girls and other times favored boys. They interpreted this as lending credence to the hypothesis that during K-12 schooling, more females (those that would be seen as mathematically weaker) self-select out of pursuing mathematics at the university level.

Boaler’s (1994) article on gender and the “reality” of mathematics represented a marked departure in terms of the research discourse on gender and mathematics—a move towards more complex and abstract parameters of gender as a social construct within the specific context of institutionalized mathematics. She contextualizes the issue of “gender and mathematics” within other social systems, such as testing and popular culture interests. The article presents a highly theorized approach, and draws on data from a 6-question interview with fifty students that centered on the “transfer” of mathematics from the classroom to the real world. The questions
themselves had specific characteristics: one abstract calculation, one related to scoring in football, one related to planting seeds and growing plants, one involved grouping numbers so that their totals were divided evenly into three groups, one involved the same type of even grouping but with chopping wood, and the final question involved a “fashion workshop.” The idea was that the questions would be mathematically equivalent pairwise (with one being abstract and one being contextualized in a sex-typed context). The students were from two schools that each took a different philosophical approach to education—one more traditional and one more inquiry-based and open.

At the more open school, there were no gender differences in correct responses to the questions, lending support to the hypothesis that a “more open, less threatening environment which values communication and negotiation encourages girls’ interests and combats [girls’] underachievement” (Boaler, 1994, p. 561). In the more traditional school, only the question about the “fashion workshop” produced a gender difference in achievement of correct answers. Boaler interpreted this as the more open pedagogical environment encouraging both boys and girls to contextualize their mathematics in real-world situations. Thus, Boaler concludes that the pedagogical environment plays an important role in the ways boys and girls learn and think about mathematics, and these relationships are related to producing or eliminating gender differences in mathematics achievement. In other words, pedagogy, socialization, and educational openness are very likely some of the “social factors” that impact the ways in which boys and girls interact with and think about mathematics. She claims that standardized tests and

---

49 Zohar and Gershikov (2008) pursued a similar line of inquiry, contextualizing the tasks given to middle school students as male-typed contexts, female-typed contexts, and gender-neutral contexts. They found that the male-typed problems produced higher boys’ scores than the girls’. Gender-neutral problem contexts created no differences in scores. Girls’ responses to the female-typed problems varied with age. Hermann and Vollmeyer (2022) also pursued this line in inquiry, finding that elementary school girls performed better on female-typed math tasks than did girls on gender-neutral math tasks; meanwhile, the boys did not experience any gain from working on male-typed tasks.
course grades (which have for a long time been the object of inquiry into gender differences in mathematics) work against the development of mathematical process-learning and, also, likely “have taken away the chance to improve the prospects of many girls trapped with ‘mathsland’—a nightmare world of conflicting ideologies” (Boaler, 1994, p. 563).

Bohlin (1994) studied the relationship between gender, course grades through the Algebra I/Geometry/Algebra II sequence, mathematics learning styles and interest, and PSAT scores from Algebra II high school students. She found that, on average, the girls in the study achieved higher Algebra I grades than the boys. Girls also generally held less interest in pursuing technical careers, as well as generally having less self-confidence in their problem solving or mathematical reasoning abilities. Girls also tended to express a desire for structure when learning in mathematics classes. This result supports previous results that females perform better on procedural mathematics tasks. Louis and Mistele (2012) later found similar results in the TIMSS 2007 data: females were likely to score higher in algebra than males, and males scored higher on other types of problems. They also found that self-efficacy did not account for this difference, but hypothesized that lack of attention to students’ self-efficacy could impact students’ course scores and thus runs the risk of impacting students’ future career choices.

Druva-Roush (1994) investigated the relationship between mathematics anxiety, gender, and problem-solving. She used two self-report instruments to gather data on students’ math anxiety and comprehension of problem-solving tasks. She found no differences in mathematics anxiety between girls and boys, nor any differences in their overall mathematics comprehension. She did however find a significant gender difference between anxiety and type of mathematics problem asked: “males that were of a moderate math anxiety level performed at an optimum level on computational, analytical problems. Females that were of a moderate math anxiety level
performed at an optimum level on non-computational visual problems” (Druva-Roush, 1994, p. 399). On the computational, analytical problems—the ones that the averagely-anxious boys did the best on—females did the worst out of all problem types. Additionally, females’ overall performance was inversely related to anxiety level. These results show that anxiety is an important factor in studying gender and mathematics, and that (as advanced by other researchers) the type of task or problem matters.

4.1 Summary of The Second Epoch

The Second Epoch can be characterized as one that privileged a plurality of approaches being introduced. On the quantitative front, these approaches included structural equation modeling of variables such as ability, exposure, achievement, and attitudes, as well as studies of differential item functioning on classroom and standardized assessments. Further quantitative studies considered ways in which numerical data on assessment was limited in its ability to reveal why the reasons for gender differences may not be possible to ascertain through quantitative methods. On the qualitative front, the social factors hypotheses were elaborated to include more studies on anxiety, confidence, and parental influences; of particular note were contributions that showed how gender differences were not static, but that they rather changed over time in school, with differences beginning in later elementary school and increasing throughout the middle and high school years. Further qualitative studies considered how socialization may lead to differential item functioning on assessments, and how pedagogy might be a factor in gendered achievement as well. In addition, studies produced in various countries began to show how gender differences in mathematics education were similar or different across cultural contexts.
The Third Epoch: Critique, Feminism, and Worldview

At this point in the development of gender research in mathematics education, we see a marked departure by the leading U.S. knowledge outlet in the field: the *Journal for Research in Mathematics Education*. Fennema and Hart (1994) issued a striking admonishment to the field: in light of two decades worth of research on the topic, these researchers argued that the task of performing and producing research is a political task, and even more so for sociopolitical issues such as gender. They claimed that “[r]esearch on gender and mathematics must be concerned with an issue much broader than what is usually considered the domain of scholarship, and that issue is the roles of women and girls in our world, in particular as those roles are influenced by mathematics. The *JRME* does not exist in isolation from the remainder of society” (Fennema & Hart, 1994, p. 648). This is a striking claim because it positions the role of mathematics education research as one that investigates the role of mathematics in social reproduction—not just the ways to ensure success in school mathematics. They noted that several themes on the topic of gender had been generally absent from the *JRME*: research on evaluating programs billed as supportive of achieving equity; critical and/or qualitative studies of gender and mathematics; teachers’ and students’ cognitive experiences apropos gender and mathematics; research that does not employ an “empirical-scientific-positivist approach” (Fennema & Hart, 1994, p. 652); and feminist research on mathematics. As a result, they call for more cognitive science and feminist approaches to the issue of gender. Particularly, they call for feminist research.

Entwisle and colleagues (1994) studied a large sample of elementary and middle school students, to investigate when gender gaps appear and what their sociological bases might be.

---

50 The reader will see a change that reflects many of these items in the literature that appeared after Fennema and Hart’s admonition.
They found that there were no gender differences in elementary school test scores. They also found that—by middle school—the students’ cognitive development inside of school was affected by their lives outside of school. In particular, they found that sociological influences outside of school had a greater impact in creating more variability in boys’ mathematics performance in middle school (as had been reported by other researchers). This variability increase due to outside influences was exacerbated by the availability of multiple mathematics tracks beginning in middle school. They concluded that “gender gaps” in mathematics appear by the end of middle school and primarily amongst high-achieving students, and thus they call for increased research focus on the sociological aspects of adolescence (outside of school) and the institutional structure of mathematics coursework in future gender research.

Hanna (1994) analyzed SIMS data to investigate how gender differences may be manifesting across fifteen different cultures and found that gendered differences in achievement varied greatly between the countries. She divided up SIMS data between seven different areas of mathematics (e.g., algebra, geometry, probability), and looked for gender differences in correct responses to problems in each of the seven categories. In Thailand, there were no gender differences in any of the categories, however, in most countries there were significant gender differences in 5-6 of the categories: “[These results] show that gender differences in mathematics achievement are not an unavoidable reality in mathematics education, since in a number of countries such differences have disappeared, if indeed they ever existed” (Hanna, 1994, p. 425). She also notes that SIMS data was not collected in such a way that further investigation into the causes of these gender differences was possible.

McCaslin and colleagues (1994) conducted an analysis of 4th graders, specifically looking at the ways in which small-group gender configurations may lead to differences in achievement...
when compared with gender at the individual student level. They found that “[t]here were no results associated with individual student gender; [but] group gender configuration emerged as an important dimension in students’ reported helping behavior and affective experiences” (McCaslin et al., 1994, p. 467). This finding lends credence to the “social factors” hypothesis insofar as social interaction necessitates gendered performance and individuals’ internal reflection (e.g., how one understands their own gender in relation to others). For example, in the context of these elementary students in small groups, gender was not a mediating factor in their engagement with solving mathematics tasks. However, the authors theorize that “[c]lassroom norms regarding gender and achievement that are coconstructed [sic] and maintained by the teacher and students will likely permeate small groups at this age” (McCaslin et al., 1994, p. 480, emphasis in original).

Miller and colleagues (1994) revisited SAT data to study whether or not the timed nature of such tests was a source of gender differences. They gave one group of students a timed version of a practice SAT exam (using the standard 30-minute allowance as called for by the Educational Testing Service), and one group of students the same exam but it was not timed. In the timed group, they found a gender difference in favor of males, as previous research had found. However, in the untimed group, “females significantly reduced the gap between their scores and scores for male students” (Miller et al., 1994, p. 436). This supports other research results that the context and modality of assessment is itself a factor in the manifestation of gender differences; since assessment data is often used to study gender differences in mathematics, the results of Miller and colleagues bear great critical implication for this research focus.

Contributing to the cultural analysis thread, Sayers (1994) studied gender differences in Zambia. He found gendered differences both in access to educational opportunities as well as in
mathematics performance. Despite advances towards gender equity in Zambia in terms of enrollment in school (which was approaching a 1:1 ratio of boys to girls upon the publication of this article), girls in Zambia still had much more negative attitudes towards mathematics, particularly in terms of “confidence, anxiety, enjoyment, and perception of utility” (Sayers, 1994, p. 401), and these disadvantages for the females were the most pronounced in mathematics classes taught by male teachers. He identifies gender as a social construct in causing situations such as this and concludes his analysis with a political call for more ethnographically grounded research: “[I]t has to be noted that the identification and analysis of gender differences in mathematics education in any situation is a sterile exercise if it ends there” (Sayers, 1994, p. 401).

Skaalvik and Rankin (1994) analyzed gender differences in mathematics amongst Norwegian students. Quite the opposite of the situation in Zambia found by Sayers (1994), they found that there were no gender differences in mathematics achievement. However, the boys in the study had higher self-concept and motivation than the girls, which meant that these differences could not be explained by achievement. Rather, they found that the difference in boys’ and girls’ motivation “was no larger than could be explained by differences in self-perceived abilities” (Skaalvik & Rankin, 1994, p. 419). In other words, the affective parameters related to mathematics and gender seemed to be circular and unrelated to actual achievement. Hendley and colleagues (1995) studied Welsh children of the same age and found similar results, that attitudes relating to confidence and self-concept were different along gendered lines. Ma (1995) found similar results when analyzing across Canadian, Chinese, and Japanese students—there were overall no significant gender interactions on achievement except in one case of geometry (in favor of the males). Cherian and Siweya (1996) found similar results amongst
South African college students, that there were no gendered achievement differences in mathematics.

Birenbaum and Kraemer (1995) took a cross-cultural psychology approach and studied gender and mathematics amongst Arab and Jewish high schoolers in Israel. They found that ethnicity produced larger effects on mathematics achievement than did gender, and these effects were more significant when attributing students’ success rather than their failure on the examination instruments. This adds weight to the hypothesis that gender as a social construct depends heavily on the specific cultural context in which it is being studied. Mittelberg and Lev Ari (1997) found similar results among the same context, that Jewish girls had lower self-confidence in mathematics than did their Arab peers, while also finding (Mittelberg & Lev Ari, 1999) that both ethnicities of girls still held lower mathematics self-confidence than their male peers. Conversely, Alkhateeb (2001) studied Arab youth in the United Arab Emirates and found no significant gender differences on test scores.

Busato and colleagues (1995) again found no relationship between gender and achievement amongst a study of 12–16-year olds that were engaged in a cooperative-style learning intervention. When compared with more traditional teaching methods, they found that both boys’ and girls’ achievement benefitted from the intervention, but girls did not benefit any more than the boys did. However, they did find that gender did have a relationship to two affective variables—pleasure and relevance. They conclude that it will be more important for future research to focus on the relationship between the ways in which teachers treat their gendered students. This conclusion adds to the complex social factors that create and sustain “gender” as a construct. This result was also supported by a study by Steinback and Gwizdala (1995) that found a relationship between the ways in which teachers interact with their students...
and the resulting impact these pedagogical interactions had on the students’ attitudes—specifically with respect to attitudes about the relevance of mathematics to students’ lives “both now and in the future” (Steinback & Gwizdala, 1995, p. 40).

In keeping with the changing tide of this epoch, Ernest (1995) contributed the first philosophical analysis of gender in mathematics. He argued that, from a philosophical perspective, popular discourse views mathematics as absolutist, meaning that it is seen by society in general as “cold, abstract, and inhuman” (Ernest, 1995, p. 449). He wagers that this creates a “critical filter” in terms of access, motivation, and social values—a filter that works especially against women in the Western cultures he discusses in the article. Taking a philosophical perspective allows Ernest to show that this view of mathematics is itself a social construct and arbitrarily assigned to the field of mathematics, but that it is very likely the primary factor in “determining the learner’s image and appreciation of mathematics” (Ernest, 1995, p. 449).

Solar (1995) contributed another theoretical development, from a feminist perspective. She claims that a feminist approach to mathematics education is inclusive in its nature, and fights against sexism that can act as a social factor in the promotion of gender differences. At the time, this article was one of the first instances of a feminist call for mathematics education and it contributed to setting the tone and direction of gender research in mathematics education for the second half of this epoch. She analyzed four dimensions along feminist lines: teaching, learning, curriculum, and environment. Along these four dimensions she identified four feminist principles: passive and active participation, omission and inclusion, silence and speech, and powerlessness and empowerment. This framework was one of the first times feminist theory had

---

51 Van de gaer and colleagues (2008) found similar results amongst Flemish high school students: that boys’ overall better performance on mathematics achievement measures was related to boys’ higher participation in mathematics. They also theorized that it was tenable that social factors were likely to explain a complex network of reasons that boys chose to participate more in mathematics.
been used to imagine what mathematics education might look like from a feminist perspective. Taole and colleagues (1995) studied gender as a mediator of classroom interactions in Botswana, and found results that supported the feminist-interactional hypothesis of Solar (1995). They found that teachers came into the classroom with gendered beliefs about boys and girls and mathematics, and that this predicated their interactions with students. Through a professional development training, Taole and colleagues (1995) found that teachers who were made more aware of their inherent gender biases were able to reflect on and change aspects of their pedagogical interactions with students that led to a “sense of guilt over the way they [had] been treating girls in their classes” (pp. 272–273).

In a similar line of inquiry, Kloosterman and colleagues (2010) used Leder’s (2001) *Math as a Gendered Domain* instrument to investigate secondary school students’ and PST elementary teachers’ perceptions of gender. They found that, generally, the students saw mathematics as gender neutral, but that males were less likely to have the belief than females. The PSTs saw mathematics as less gender-neutral than did the students. The students (both males and females) also saw gender playing a role in how teachers interacted with them, such as students’ perceptions that teachers were more interested in boys’ distraction-causing and girls’ caring-to-do-well. The data also showed that male students who were doing well in mathematics saw mathematics as more gender-neutral than did the lower-performing males; this was not present in the females. Conversely, Duru (2011) used the same instrument amongst Turkish teachers and found no gender effects on PST elementary teachers’ beliefs.

Penner and Paret (2008) revisited previous findings that gender differences are not evident in early childhood mathematics education, looking at kindergarten data from the Early Childhood Longitudinal Study. They found that gender differences do present as early as
kindergarten. In particular, they found that—in keeping with previous results on males’ greater variability—boys initially did better “at the top of the distribution and worse at the bottom” (Penner & Paret, 2008, p. 239), but that this difference seems to vanish by 3rd grade. They found that, amongst the kindergarten boys at the top of the distribution, their advantage was largest in families with “high parental education, suggesting that gender dynamics in middle and upper class families have important implications for continuing gender segregation” (Penner & Paret, 2008, p. 239). Chang and colleagues (2011) later picked up the same line of inquiry, and found that preschool-aged children were quite susceptible to mathematical talk from their parents (such as introducing their children to numeracy); they also found that “the stereotype of male dominance in math may be so pervasive that culturally prescribed gender roles may be unintentionally reinforced to very young children” (Chang et al., 2011, p. 440). Another finding in support of this argument (that early numeracy is equivalent between the sexes, and thus that observed differences are due to something other than cognition) was that of Bakker and colleagues (2018), who studied Belgian preschoolers and found no gender differences in achievement on numeracy tasks. They claim that, in light of the “substantial” evidence in support of that finding, early numerical equality between the sexes “probably do[es] not explain later-reported gender differences” (Bakker et al., 2018, p. 1).

5.1 Summary of the Third Epoch

The Third Epoch can be characterized as one that privileged the beginnings of calls for feminist and critical research on gender in mathematics education. Researchers from around the world offered studies from their respective contexts, contributing to the development of a more “global” view of the issue, thus providing more insight into the influence of cultural contexts on gender and mathematics. Apropos of contextual influences, researchers further considered how
assessment modalities might bias results along gendered lines, how teachers might reinforce gender norms beginning as early as elementary school in how they interact pedagogically with boys and girls and how this might change across cultural contexts, and how cultural and social contexts might lead to greater variability in boys’ mathematics achievement which could shape the interpretations of quantitative studies’ results. Detections of equitable achievement in early elementary mathematics achievement provided evidence that gender differences in the middle and high school years were likely not attributable to biology but rather to socialization processes. In addition, studies that contributed to the feminist slant considered how teachers’ bias might prefigure their interactions without their awareness, and how socioeconomic class can act to reproduce gender norms in mathematics.

6 The Fourth Epoch: Critical Psychology, Critical Theory, Critical Methods

Perhaps the advent of the new millennium led to refreshed and different views on the issue of gender and mathematics. This timeframe began an era of critical approaches to such research that cultivated a culture of critique that continues in the present day. The reader will see a shift in tonality in the research that is reported next, especially when it is contrasted with continued threads by some researchers out of the previous epochs I have already surveyed.

Barnes (2000) contributed what may be considered the most important new work on gender and mathematics in many recent years, and it could be seen as setting up a new era on this research focus. She reported on an ethnographic study of a classroom where she looked at the forms of masculinity that were being exercised. This was contra to much of the previous literature in that the mechanics of masculinity were studied rather than women’s underachievement. In her ethnographic study, she found two types of masculinity in the mathematics classroom: the “Mates” and the “Technophiles.” The Mates were characterized by
hegemonic masculinity: “They were able and ambitious, but restless and attention-seeking and frequently initiated off-task talk and banter” (Barnes, 2000, p. 145). The Technophiles, meanwhile, “were rather isolated in class. They had poorer communication skills and valued obtaining an answer quickly more than justifying it to others” (Barnes, 2000, p. 145). By investigating different types of masculinity, Barnes was the first to consider that boys might not be a homogenous group. Hanna (2003) later called similarly for studying masculinity in mathematics, that boys presented a “new” equity concern, citing the high variability in their achievement.52

Following previous calls that gender socialization in mathematics may begin earlier than it manifests in test scores, Tiedemann (2000) problematized elementary teachers’ beliefs regarding gender and found that they gendered logic skills. The elementary teachers believed “their average achieving girls were less logical than equally achieving boys” (Tiedemann, 2000, p. 191). The teachers also believed mathematics was harder for the average achieving girls. As a result of this belief, the teachers “attributed [girls’] unexpected failure more to low ability and less to lack of effort than with boys” (Tiedemann, 2000, p. 191). This lent credence to the stereotype threat component of the social factors hypothesis. Similar work from Leedy and colleagues (2003) found similar results, that beliefs of the adults in children’s lives (parents and teachers) were crucial to studying gender and should focus on stereotype beliefs. They found that, similar to previous research, boys and their fathers admitted more sex-typing stereotype beliefs about mathematics as masculine than when compared with girls and mothers (the latter who, in their study, did not stereotype mathematics as masculine at all).

52 One notable omission I have made from the present text is that of Heather Mendick’s (2006) book, *Masculinities in Mathematics*. The book is a substantial contribution to theory in this research area, but for consistency I have chosen to focus on research articles in the present text. However, the reader can begin to see the influences of Mendick’s work in the epoch of the 2010s–today, such as exemplified in Llewellyn (2009).
In what might be called a critical-quantitative approach, Li (Q. Li, 2004) proposed a new cognitive model for studying gender that incorporated beliefs. Her model consisted of external influences (teachers, their beliefs, and classroom interactions) and internal student-level variables (students’ cognition, behavior, and beliefs). These two groups of variables then interact in different ways to produce gender differences in mathematics. She found, upon testing her model, that teachers’ beliefs were critical when studying gender and mathematics (e.g., teachers’ and students’ beliefs about the importance of different types of mathematics were very different), and further found that types of mathematics were related to different beliefs along gendered lines (e.g., males believed numbers and operations were more important than females). This suggests that teacher and student beliefs needed to be studied in relation to gendered achievement.

In what might be called a critical-psychology approach, Skaalvik and Skaalvik (2004) brought in the concept of the ego, and performed a large scale study of Norwegian students. They found that male students—in addition to having higher self-concept, intrinsic motivation, and expectations in their performance in mathematics—also engaged in a more egoic orientation towards mathematics performance. They coupled this with parallel instruments that assessed beliefs about learning language, and found that female students had higher intrinsic motivation than did the males. In addition, they found that older students had higher self-concept in language studies, both males and females. Van de gaer and colleagues (2004) took up a similar line of inquiry, and studied whether these differences between math and language classes were more or less pronounced in Belgian single-sex versus coeducational schools and classes. They found that, for boys, an individual class’s gender makeup was more important to them than was the gender makeup of the entire school. They also found that boys made “more progress for language (and not for mathematics) in co-educational classes. Girls, on the other hand, [made]
more progress for mathematics (but not for language) in single-sex [schools]” (Van de gaer et al., 2004, p. 307). This result complexified the way in which researchers were tasked with viewing the effects of gender at different levels of unit of analysis, in addition to the new proposition of comparing math-gender differences with language-gender differences.

In the technological advent of the 2000s, Vale and Leder (2004) studied how the use of computers in mathematics may produce gendered results. They found that middle school girls held more negative views towards computers in mathematics classes, citing equipment failures that would thwart their labor efforts. Meanwhile, the middle school boys held more positive views, citing the novelty of using technology. This lends support to previous hypotheses that it may not be the mathematics itself but rather the type of activity in which the mathematics is framed that can produce gendered results.

Spelke (2005) took a critical psychology approach to defend cognitive development as shared between males and females. Her critical review of existing literature found that psychological claims about boys’ and girls’ different inclinations for types of activity in childhood were not based in biology but rather in socialization. She found that—in support of the potentiality of females’ mathematical cognitive development—both males and females have the same biology-based “cognitive capacities,” which leads both males and females “to develop equal talent for mathematics and science” (Spelke, 2005, p. 950). In other words, the biological argument that males have higher aptitudes for mathematics was not supported by the literature; instead, she calls for psychologists to “look beyond cognitive ability to other aspects of human biology and society for insights into [the phenomenon of] gender differences in mathematics” (Spelke, 2005, p. 956).
Vithal (2005) took up another critical endeavor, using a feminist approach to study sexism in mathematics. She found that, in the case of South African students being taught to measure using different tools, girls faced a large amount of sexism in participating in the measurement activities. This result added more support to the social factors hypothesis and the gendered types of activity hypothesis, and revealed sexism (a concept within critical theory) to be important in studying gender differences. In a similar vein, Asimeng-Boahene (2006) studied meta-analytically the current state of mathematics education in African countries, and also found that gender-math inequity can be linked to girls’ opportunities and quality of education in mathematics. He found several structural “social factor” culprits contributing to this inequity, especially gender bias and policy discrimination.

In a very different cultural context, Brandell and colleagues (2007) studied what might happen if Swedish students were asked to rate the gender-typing of mathematics as male, female, or gender neutral. They found that, in line with much previous research, mathematics overall was viewed as a male domain, but that this typing was most pronounced by minority students. In addition, some aspects of mathematics were typed as female, overall by students. They compared these results with colleagues who had used the same instrument in Australia and found that Australian students were more likely to rate aspects of mathematics as female. Also in Sweden, Eriksson and Lindholm (2007) studied a similar relationship, where a mathematics test was given to a control group and an experimental group. The experimental group was subjected to a manipulation wherein their gender identity was called into reference by researchers. They found that “[m]en performed better than women when gender was made relevant among participants who did not see their gender as an important aspect of their identity” (Eriksson & Lindholm, 2007, p. 329). This lends credence to the stereotype threat aspect of the social factors argument,
in that “gender relevance manipulation affected men’s performance more than women’s” (Eriksson & Lindholm, 2007, p. 329). In other words, by differentiating the extent to which gender-typing was introduced into the testing environment, the researchers “made gender matter” more to the men than the women.

Stereotyping was also the focus of Muzzatti and Agnoli’s (2007) study that investigated its relevance in the Italian elementary and middle school contexts. They found that, amongst the elementary students, stereotype salience (that high math achievement was masculine) led to a degradation in the girls’ performance. Amongst the middle schoolers, the initial stereotype threat that emerges at the end of elementary school then continues to create consolidated and more engrained detrimental effects on the girls’ affect. In this way, they showed the susceptibility of elementary-aged children to the social factor of stereotyping mathematics as a male domain even at a young age. Tsui (2007) found a similar effect of stereotyping amongst Chinese high school students, that the male-typing of mathematics compounded with cultural preferences for boys and the selection track system of high school mathematics coursework, which combined to create a gender gap in mathematics achievement in those students.

Wedege (2007) suggested a new framework for studying gender in mathematics that includes four dimensions: structural, symbolic, personal, and interactional. To construct the model, Wedege drew on feminist theory to distinguish between gendered identity (“I am a man”) and gendered subjectivity (“I am me”). Structural gender is the notion that “gender constitutes a social structure” of uneven distribution (Wedege, 2007, p. 253); symbolic gender is the notion that “gendered structures gradually form the gender symbols and discourses… in people’s heads” (p. 253); personal gender is the notion that “gender is seen as a personal matter and a reality for everybody” (p. 254); and interactional gender is the notion that “gender is seen as something
created and reproduced continuously through social interaction (negotiation)” (p. 254). To date, this seems to be one of the most substantial developments in gender theory for mathematics education. 

Summarizing the literature on gender differences in problem solving up to this point, and notwithstanding the feminist and critical suggestions that had been recently circulating, Zhu (2007) found that gender research in mathematics could be grouped into several categories: Biology—(1) sex differences in “brain lateralization” function; (2) sex differences in brain structure; (3) influences of sex hormones; (4) sex differences in brain activities whilst processing information; Psychology—(5) learning styles; (6) student attitudes; (7) stereotype threat in testing situations; and Experiential—(8) socioeconomic class; (9) socialization; and (10) differential course enrollment. Zhu suggested that all of these are likely to be the “causes” of gender differences in mathematical problem solving.

Brunner and colleagues (2008) attempted to reinvigorate the cognitive science argument, by studying data from nearly 30,000 9th graders and developing a standard model and a nested-factor model. They found that, overall, small advantages in favor of the boys were found, which generally comports with much previous research. They also found much larger differences in favor of boys in specific mathematical areas, such as visual-rotational cognition. In light of these results, they claim that, when general mathematical ability is the frame used for investigating gender differences, their model suggests that small male advantages will always be found. However, they note that the larger differences and variability in specific mathematical abilities should be considered further by researchers, as skill-specific inquiries. They ask that, overall, should the question of mathematics and gender differences really be reconsidered?—Or is this just what it is?
Hyde and Mertz (2009) used large-scale data from multiple countries and performed a cross-analysis to see trends. They found that, in the U.S., girls’ mathematics performance has risen to the point that there is no gender gap with boys, and that this trend is also being seen in some other countries as well. Amongst mathematically gifted youth, they found that more men still perform in the highest five percentile ranks, but that this earlier-detected trend has also been closing to the point that it is not found in some countries despite still being found in the U.S. Regarding the higher males’ variability in mathematics performance, their analysis revealed that it correlates with “several measures of gender inequality” (p. 8801), indicating that it is a complex issue that is socially rooted and not biological in nature.

6.1 Summary of The Fourth Epoch

The Fourth Epoch can be characterized as one that privileged contemporary ways of theorizing and studying gender in mathematics education, such as considerations that masculinity was not homogenous, the role of teachers’ beliefs in the “genderizing” of different types of mathematical skills, complex theorizations about gender, and an uptake in the notion of stereotype threat; despite the latter having been suggested by Fennema and Sherman (1977), it was not really included in gender research until this epoch. Additionally, this epoch included elucidations that “gender research” in mathematics education was—itself—not homogenous, with different studies focusing on essentially different angles of gender entirely: these contributions, supported by increasingly complex contemporary ways of thinking about gender, indicated that different gender researchers may be talking about fundamentally different research problems subsumed under the label “gender.” This problematization and complexification of the concept of gender itself (and to what it circumscribes in the field’s research), evidenced in the
Fourth Epoch, would set the stage for the inherently “critical” nature of the Fifth (and final) Epoch.

7 The Fifth Epoch: “Doubling Down” on Critique, and the Horizon of Bioscience

The final epoch of gender research is roughly delineated by the appearance of the classic Damarin and Erchick (2010) editorial that claims: “[I]t is time to take a new turn by acknowledging that the relationships of gender to mathematics education are much more complex than once thought… [C]larity must supplant vagueness in the meaning of gender in mathematics education research” (p. 321). As an illustration of this, Esmonde (2011) introduced the notion of genderism in a study of mathematics classrooms. This allowed them to posit the “gender issues” thread in mathematics education as being a subset of larger social systems, and thus approaches to gender equity need to reflect society generally and not just classrooms. For example, textbook problems and typical teacher education material is infused with genderism that exists in social constructs. As a result, this epoch of gender research sees a “doubling down” on critical and subjective approaches, and a new emphasis on philosophy and critical types of psychology and sociology—as well as a shift to more theoretical analyses and away from the privileging of empiricism and empirical results—can be seen in what follows. As a result of these shifts, the process of summarizing articles becomes much more difficult, because the form of the research constitutes its message. Thus, in abbreviating the form, the knowledge also becomes curtailed.

Knowles (2008) studied the gender differences in mathematics in underprepared college students. She found that, during a recurring tutoring workshop with introductory statistics students, the underprepared women (who knew they were underprepared due to their enrollment in the tutoring opportunity) relied heavily on (1) under-confidence, (2) depression, (3) anxiety,
and (4) “troubling attachment”\textsuperscript{53} to the tutor as a defense mechanism for their underpreparedness in the social situation of the tutoring group. Meanwhile, the underprepared men (who also knew they were underprepared for the same reason) relied on overconfidence, grandiosity, and resistance as defense mechanisms. This was one of the first studies to consider the psychic nature of gender in precarious situations of mathematics from a relational perspective.

Esmonde and colleagues (2009) performed a rather innovative study on patterns of group work and gender. They employed a combination of critical race theory, psychology of stereotype threat, and the sociological theory known as expectation states theory which theorizes how people form expectations for each other in activity. Using this approach, they interviewed high school students from two different schools about their interactions between group members in mathematics class. They coded their observation data for interaction style, content understanding, friendships/relationships, and social identities. They found that, during the interviews about group work, girls were most likely to talk about gender. The interviews also focused on ways in which the conversations during group work were controlled by group members. They found that heterogeneous small groups tended to proceed in ways that allowed privileged groups—especially the White boys—to control the flow and interaction within the groupwork. This sheds light on an important social factor that may be mediating the ways in which boys and girls experience participation and belonging in mathematics classes, as well as potential constraints on opportunities to learn.

\textsuperscript{53} Knowles (2008) used the phrase “to protect underdeveloped mathematical selves” (p. 673), although for the purposes of the present review, I interpret this in the more generally understood phrase “defense mechanism,” notwithstanding the implications that such a phrase may have in psychological research. Knowles’ use of “troubling attachment” in the article seems to be on a conscious level as a designation of something out-of-sorts. There are plenty of psychoanalytic implications from a relational perspective of the defense mechanism, which I forego in the present text for relevance.
Llewellyn (2009) took a poststructural (Foucauldian) feminist perspective on her study of identity development in two prospective mathematics teachers (PSTs), not disclosing the gender of either and assigning both androgynous pseudonyms: Alex and Sam. She drew on the work of Valerie Walkerdine, Margaret Walshaw, and Heather Mendick, who have focused on contemporary theory and its application to mathematics education. This approach allowed her to study gender’s effect on teacher formation within neoliberal society. Her analysis revealed three themes in the interview data: control, choice, and confidence. She frames these themes within psychic structures such as fantasy and fictions. Regarding control, Llewellyn found that the PSTs saw doing mathematics as doing control. She links this with the masculine, rational, autonomous self which does not exist, and contrasts it with the feminine which she calls a quest for understanding. These notions reflected the PSTs experiences themselves as students in school and their desires in becoming teachers. These subjective experiences led the PSTs to discuss things like the ineffectiveness of their own teachers in motivating them to become mathematics teachers themselves (such as in self-referential statements concerning “I”). Regarding choice, she draws on the Foucauldian notion of power and situates personal choice within systems and relations. This allows her to analyze interview data along the lines of the PSTs choices to become teachers despite having to contend with “a process of governmentality [aimed at] normalization” (Llewellyn, 2009, p. 419). With respect to their future students, the PSTs also espoused beliefs about students’ needing to choose whether or not they wanted to be successful in mathematics. Exercising such a position, Llewellyn’s analysis showed how this position exercises the masculine rational position on their students in the same way it was exercised on them, regardless of their own affective realities—such as their confidence. Regarding confidence, she found that confidence in security structures the ways in which truth is posited in modern
classrooms, namely in an essentialist vein. This trend is illustrated by the pedagogical
imperatives on students to be willing to learn and volunteer answers. Confidence in the PSTs also
tended to take forms such as masculine dominance that would be in alignment with the
archetypal mathematician. The more confident of the two PSTs was Alex, and he engaged in far
more fantasy and fiction in his interview answers than did Sam. Overall, Alex’s discourse took
the masculine position and Sam’s took the feminine position. By viewing gender as something
performed rather than “is,” Llewellyn showed that “gender” is really a system of games that
people play with each other, and thus other types of research on gender do not actually capture
what it is.

Taking up a similar line of inquiry to Esmonde and colleagues (2009), Langer-Osuna
(2011) studied group interaction dynamics to investigate how social identities for a girl and a boy
changed over the course of a project-based activity in a classroom. This girl and boy were
serving as leaders for their respective groups. Langer-Osuna found that they interpreted their
roles as group leaders in gendered ways, with the girl evolving from a position of leadership to a
position as “boss.” The boy, meanwhile, evolved from a “quiet loner” to an ally with his
teammates. Through her observations, Langer-Osuna observed why this may be occurring: that
the girl was not given the appropriate authorial respect by her peers in the group, having to
contend with a “bossy” attitude to control the group. This led to her eventual ostracization from
the group dynamics. On the other hand, the boy was afforded respect by his teammates and was
able to evolve into the role of an “ally” in his group. These results led to the girl’s eventual lower
understanding of the concepts of the lesson, while the boy benefitted from a full learning
experience and was able to meet the content demands of the lesson. This led Langer-Osuna to
theorize that the ways in which marginalization and privilege are socially constructed in
classroom situations predicates how group members respond to their leaders. In this way, Langer-Osuna’s work supports the notion that gender is much more than a deterministic identity, but that it predicates the ways in which one forms relations with others in pedagogical situations.

Beasley and Fischer (2012) studied the effects of stereotype threat on attrition from STEM college majors. They found that minority students experienced stereotype threat more than White students, but that women did not experience it more than men. Notwithstanding this result, their data also showed that stereotype threat was a leading cause of women’s, minorities’, and White men’s attrition from STEM college majors. Stereotype threat, for these groups, was compounded by performance anxiety. They conclude that “stereotype threat is instrumental in undermining the ambitions of minority and female students from majoring in STEM fields” (Beasley & Fischer, 2012, p. 444), and also noted that more research into stereotype threat needed to be done to understand how it was affecting the White men who left their majors.

In a surprising finding from a quantitative analysis, Wei and colleagues (2012) found that Chinese middle school girls outperformed boys in many types of mathematics tasks, but that this difference was eliminated when language skills were controlled for. This result “suggest[s] that girls’ advantage in arithmetic is likely due to their advantage in language processing” (Wei et al., 2012, p. 320).

Rands (2013) was one of the first to take a transgender theory approach to gender research in mathematics. They developed a framework of gender-complex education for use in mathematics classes, which included gender sensitivity (continuous reflection on the ways in which gender was functioning in a situation) and gender complexity (teaching children about gender vocabulary and gendered pronouns) as a way to combat genderism, such as the prevalence of gendered contexts in mathematics classes and tasks. They claimed that such a
framing would support gender-nonconforming students in mathematics and work against the
gendering of the field of mathematics. Rands (2009, 2019) also invented the term *mathematical
inqueery*, which expands their former concepts into a praxis, method, and politic of mathematics
education. This goes beyond a tokenistic approach to “inclusion” of all genders and sexualities in
mathematics, and instead affords a “queering” of mathematics’ applications as taught by teachers
and advanced by society.

Halpern (2014) suggested a complex-systems approach to the “gender problem” in
mathematics. In such an approach, a “holistic worldview [allows researchers to understand] that
‘everything’ is connected” (Halpern, 2014, p. 73), such as the activities that young boys and girls
engage in impacting their choices and the views with which they see mathematics in the world.
For example, girls decorating and sewing at home requires spatial skills that are rarely reflected
in mathematics test items that then lead to results showing that boys do better in spatial tasks.
Later, Weldeana (2015) studied the sex-typing of everyday materials and its relationship to
gameature achievement in Ethiopian high schoolers, and found that sex-typing of material objects
leads students to interact with geometry problems involving the same objects differently for boys
and girls.

Bench and colleagues (2015) took up an earlier line of inquiry by Dahlbom and
colleagues (2011) and found similar results apropos students’ estimation of mathematics
confidence before and after a test. The men continuously overestimated their confidence on
mathematics tests, and women continuously underestimated their confidence. Their results
suggested something new: that gender gaps in STEM fields may not be “the result of women
underestimating their abilities, but rather may be due to men overestimating their abilities”
(Bench et al., 2015, p. 536). This line of argumentation is very much in line with the critical approaches of this epoch of gender research.\(^{54}\)

In another way of looking at a “complex” view of gender, Chen and colleagues (2016) found that, in a flipped mathematics class, feelings were more likely to predict males’ course grades than females, but that females’ grades reflected course pedagogical design. When differing levels of interest were controlled for, the students in the sample performed equally well in the class. In keeping with this line of inquiry, Coenen and Van Klaveren (2016) sought to find whether or not the gender of the teacher—as a component of the course design—would impact students’ test scores, and found that it did not.

Solomon and colleagues (2016) offered yet another first for gender research in this epoch, in their study of one female mathematician-in-training. They drew on theories developed by Leont’ev and Holland to study how identity interacted with world-making for this emerging female professional. They theorized a complex interaction between identity, agency, and participation, asking key questions such as, “How might those who do not or cannot participate in mathematics come to see themselves as doing so” (Solomon et al., 2016, p. 57). In addition, they connect this to the formation of figured worlds to theorize how the activities one chooses to participate in influences their identity development: “[I]n choosing, we exercise agency in authoring the self” (Solomon et al., 2016, p. 58). Finally, they bring in the concept of hybridity in the process of world-making, to theorize how, for example, feminist thought can become infused with authoritative, masculine discourse in the struggle for feminism’s goals. The hybridity that results reflects how new identities are possible. Using this frame, they talked to a previous research participant who was pursuing her PhD in mathematics. Solomon and colleagues (2016)

\(^{54}\) While not germane to the present text, this is one of the key arguments that psychoanalysis allows us to explore and understand.
found several themes in the interview data with the student: (1) hybridity formation “amidst binary discourses” (p. 62); (2) “struggle and fragility in enacting hybridity” (p. 63); (3) a leading identity was needed to enact hybridity; (4) hybridization was a practice that allowed the student to “make her own world” of mathematics. The possibilities afforded to the student in terms of pursuing hybridity and world-making allowed her to reflect on her professional formation with the epithet: “I can actually be very feminine here” (Solomon et al., 2016, p. 67). The approach employed by these scholars show how gender and identity are dynamic, relational, and enacted aspects of one’s self—and it allows a hybrid/contradictory subject position to be theorized that goes beyond the inquiry into a “‘feminized mathematics’ or a ‘mathematized woman’” (Solomon et al., 2016, p. 69). In a similar line of inquiry, but at the secondary level, Kim and colleagues (2018) performed a large meta-analysis on stereotype research in STEM fields at the secondary level, and found that women “experience challenges to their participation and inclusion” as a result of negotiating social identities in STEM classes. Sumpter (2022) took a similar line of inquiry, but focused on why women might in fact leave, and found that for some women, the gendered nature of power relations in pursuing a mathematics PhD caused them to disidentify with a future career in a university mathematics department.

Leyva (2017) offered a foundational review of literature on gender in mathematics education up to this point, working from a critical theory perspective. The paper quickly became an important entry into the literature on the topic. He clarifies that throughout the history of gender research in mathematics, quantitative studies of achievement have flourished (reflected in the quantity of them surveyed in the present text), that they often conflate gender and sex and thus fall short of being able to theorize how masculinization structures the mathematics field. A primary conclusion of the article is that intersectional analyses must be privileged in future
research, because they allow for complex ways of conceptualizing and investigating “gender” as a dynamic and complicated construct, such as in relating personal identity to interaction with others and their influence, as well as the contextual parameters within which gender mediates those interactions. As a comparative example of this, he spotlights how race studies have revealed the invisible ways Whiteness functions, and claims that gender functions in much the same way.

van de Werfhorst (2017) conducted a review of Dutch data on educational achievement between the 1930s and 1980s, and found that gender differences in mathematics have narrowed, but that this “trend has stalled” (p. 449). One of the main reasons for this is the interaction with SES status. He found in his analysis that gender-typing remains strongest in lower SES strata and families. As a result, higher-SES girls are more likely to pursue mathematics-related degrees in college. This conclusion brings a critique of postmodern and neoliberal approaches to gender research, by avowing the role of economy in structuring gender relations. A similar result in Chinese students was found the next year, when Li and colleagues (M. Li et al., 2018) found in a meta-analysis that 5th grade girls in lower-SES schools were outperforming boys in mathematics achievement in those schools, and that in higher SES schools, the variance was far smaller. Urban schools also had smaller gender differences than rural schools. In the same year, Zhu and colleagues (Y. Zhu et al., 2018) studied Chinese PISA data and also found that socioeconomic class had a significant relationship to gendered achievement, but that when this and other “social factors” were controlled for, no gender differences were observed. In particular, they found that this relationship between SES and gender negatively impacted girls’ achievement more than boys. Reardon and colleagues (2019) found a converse result when analyzing testing data across
10,000 school districts in the U.S.: “Math gaps tend to favor males more in socioeconomically advantaged school districts” (Reardon et al., 2019, p. 2475).

Charlesworth and Banaji (2019) offered a neuroscience approach to the issue of gender and mathematics and found that one of the key neuroscience insights was related to implicit bias, which they defined as the “mental processes that exist largely outside of conscious awareness and control in both male and female perceivers and female targets themselves” (Charlesworth & Banaji, 2019, p. 7228). They claim that neuroscience can be used to investigate the ways in which people can “change [their] beliefs and behaviors, as well as organizational culture and practices” (Charlesworth & Banaji, 2019, p. 7228).

Gholson and Martin (2019) introduced the concept of Blackgirl Face, as a concept describing a mask or façade that a Black female middle school student donned in her relationship with mathematics as a student. The theoretical power of this concept is that it allows the “learning” of mathematics to be conceived as a performance of continuous social negotiation rather than atheistically cognitive in nature. By privileging the social, interactional, and performative dimensions of the pedagogical situation, the student’s emotions and material work are put front and center, such as pain and relational labor. This results in an analytic apparatus that affords concepts such as “learning mathematics while Black” and “learning mathematics while female.” Leonard and colleagues (2020) employed another version of Black feminist thought in their analysis of life-course narratives from Black families and found that oppressive structures such as racism and genderism connected familial women in their mathematics experiences across five generations. Both of these studies suggest that using innovative theoretical approaches such as gender/race/class have the potential to reveal more information about gender than more traditional analytic lenses.
Berg and colleagues (2020) were the first to suggest that teachers’ grading practices may contain gender biases. They studied Swedish middle school teachers’ practices in assessing their students’ work, and found “a substantial grading difference, consistent with grading bias against boys” (Berg et al., 2020, p. 915), indicating that teachers exercise discretion when grading and that this can produce gendered results in classwork scores. In a complementary and new line of inquiry into the impact of “external” forces on creating gender gaps, Coffman and Klinowski (2020) studied policy changes in standardized testing in the Chilean context and found that, among the top percentile ranks (i.e., “talented” students) on the national standardized mathematics test, “simply removing penalties for wrong answers reduces a sizeable gender gap in questions skipped” (Coffman & Klinowski, 2020, p. 8794). In the Danish context, Sortkær and Reimer (2022) also found that boys received the most feedback from teachers and girls received the most feedback from peers, suggesting that the social link and social positions are critical for understanding the ways in which gender is manifesting in institutional mathematics situations. In this way, these researchers shed some new light on previous research that revealed differences in the ways that boys and girls approach environments of testing and feedback.

Johnson and colleagues (2020) presented results from a large NSF study on an active-learning intervention in U.S. undergraduate mathematics and found that the intervention created a gender gap in achievement when there was no such gap in a national representative sample which captured the traditional lecture environment. The reasons for this were theorized by myself and Johnson (Moore & Johnson, 2021) and employed a dialectical and psychoanalytic interpretation of the ways in which females and males relate to each other in different pedagogical situations, placing the burden of “taking action” on the side of the females when the capitalist mode of school does not require a parallel action by the males. In the Estonian context,
Kaldo and Õun (2020) found similar results but for reversed reasons: they studied learning strategies in undergraduate mathematics and found that females held overall more positive views of the learning strategies of organizing and repeating. When the females used these two methods (compatible with traditional lecture environments), they performed better in class. Another line of inquiry compatible with this was performed by Lewis (2020) who studied the patterns with which undergraduate mathematics students would take advantage of an oral re-assessment opportunity after a written test, and found that females opted for the re-assessment “at greater rates than male students” (Lewis, 2020, p. 539). As a result, he calls for more attention to the way that stereotype threat and methods of reducing student anxiety in research that focuses on gender.

Also in the undergraduate context, Leyva and colleagues (2021) offered another critical sociological approach to understanding how students experience introductory college mathematics courses. They found two logics at work in students’ experiences as a result of their qualitative analyses: (1) the relationship of teacher to student was overdetermined by the teachers’ content authority in the classroom; (2) the coursework in the introductory calculus class was used as a “weed out” tool for students “not cut out for STEM” (p. 784). As a result of these findings, they were able to reveal how these logics operated along gendered (and racialized) lines in the classroom: that “seemingly neutral instructional practices… reinforce[d] racial-gendered distribution[s] of classroom participation… and persistence [in introductory mathematics]” (Leyva et al., 2021, p. 784). Also utilizing narrative analysis techniques, Leyva (2021), in a separate paper, developed the framework of counter-story-telling for research on gender and race. He utilized the framework to reveal how group tensions in mathematics classes were reflected in Black women’s story-telling about their experiences. These within-group tensions,
Leyva (2021) defined as “[being] a function of internalized racial-gendered ideologies and normalized structural inequalities” (p. 117). Along with Dan Battey and other colleagues (Battey et al., 2022), Levya continued this line of inquiry and focused on the labor of students’ work in these introductory calculus university classes. Their findings showed that the labor produced by women and racial minorities in their mathematics coursework reflected their race and gender; thus, they conclude that the content itself is subordinate to the emotional and cognitive labor produced by these marginalized students in pursuing mathematics course success.

At this point, we see the emergence—in just the last few years—of some calls for queer theory in the study of gender in mathematics. Yeh and Rubel (2020) ushered in this recent era, with their book chapter on disrupting binary oppositions in PST education. They used Thomas Nail’s theory of borders and Anzaldúa’s borderland philosophy to theorize how schools reproduce gender and sexual borders to problematize much of the literature reported in the present text. In particular, they call out the ways in which studies ignore the conflation of gender and sex, and how research that analyzes quantitative achievement data without considering sociocultural factors further obfuscates the ways that gender is functioning. As a queered alternative, they focus on the potential for researchers and teachers to focus on the borders that divide binary opposites: such an approach holds potential for queering these borders and mathematics itself.55

Ferretti and Gilberti (2021) studied Italian high school students’ performance on standardized tests, finding a gender gap in favor of the boys. Their quantitative analysis found

55 Moore (2021) and Moore and Johnson (2021) employ a similar approach with queer theory and Nail’s theory. Since they are my own papers, I refrain from elaborating on them more here. The general thrust of both papers, apropos queer theory and borders, is that atypical ways of thinking about gender are needed in mathematics education, that is, ways of thinking about gender that come from outside the field’s typically- and historically used approaches.
results similar to previous work, in that the gender gap is largely due to “the fact that there are fewer girls reaching highest [sic] ability levels than boys” (Ferretti & Gilberti, 2021, p. 1731). They then used interview data to investigate the gap from the students’ perspective and found that metacognitive factors had a strong influence on girls’ in answering some of the tasks. The metacognitive factors they identified from the interview data were: insecurity, and low self-confidence in explaining mathematical reasoning. Such analyses hold potential in showing how gender is enacted, dynamic, and relational, and show how innovating apropos the “social factors” hypothesis still has much to reveal about gender in mathematics.

Several authors, including myself, contributed to a special issue of the *Mathematics Education Research Journal (MERJ)* on innovations in gender issues research. Forgasz (2021) claims that the study of gender is a problem for large-scale studies, citing the mountain of prior evidence that large-scale studies can produce different results apropos gender depending on a multitude of social and contextual factors, as well as the inability of quantitative studies to capture a subjective variable like “gender.” For example, she notes how gender diversity cannot be captured by a numerical or binary variable, and thus the only way to collect such data in a quantitative way means “suppress[ing] or subsum[ing] under the binary categories” (Forgasz, 2021, p. 636) the data collected on “gender.” She also calls attention to the ways in which researchers are still using the terms gender and sex, with varying definitions. For those wishing to pursue large-scale studies, she suggests (1) using the concept of “gender” instead of the determinant “sex,” (2) at the very least including a third category on quantitative data for an ‘other’ gender, (3) allowing this third category to be an open-answer field type, (4) providing descriptive statistics for each gender group as a matter of quantitative methodology, and (5)

---

56 As I previously stated, I will forego commenting on my own paper, (Moore, 2021), in this special issue.
making explicit in quantitative analysis “which gender groups have been included, and why other groups may have been excluded” (p. 638).

Another article in the MERJ special issue was Jaremus (2021), who studied what would happen to a reader of research if the author intentionally obscured the gender of the students they were writing about. She used qualitative data of interviews on students’ mathematics participation and did not specify a priori whether the case studies were male or female students. Her analysis revealed that “the reasons why these students chose to participate in [an advanced, non-compulsory mathematics course in an Australian high school] do not distinguish them by their sex/gender” (Jaremus, 2021, p. 713). In fact, when the interview data was read without any gendering of the respondents, both students (whom later it was revealed were one boy and one girl) performed femininity and masculinity at different points. Most interestingly, in analyzing these students’ performativity, Jaremus demonstrated that “when femininity was performed [by the students], both students’ subject choices were primarily characterized as masculine performances, including establishing themselves as having mathematics brains and seeking to use their [math] participation to attain prestige” (p. 713). This innovative approach shows how “gender” can become attributable and aligned with personal desires if heteroglossic approaches to understanding gender are employed. Such approaches contextualize the masculine and feminine in relation to each other and to the social situations that students find themselves in.

Also in the MERJ special issue, Kersey and Voigt (2021) developed a tool for allowing undergraduate STEM students to “map” their identity formation and development in relation to the mathematics fields. Their tool includes two axes: (1) gender category oppression to gender category privilege; and (2) gender transgression oppression to gender conformity privilege. When piloted with some transgender and queer undergraduate mathematics students, the tool
revealed that not only was gender conformity a dimension along which privilege operates, but that gender transgression was actively experienced as grounds for oppression by others. In addition, the differences between gender categories could be experienced as oppressive or privileged. For example, “a student’s gender identity does not always match their gender presentation, and how others interpret that gender presentation does not always coincide with what was intended” (p. 751). As a result of these insights, they call for a deconstructivist approach to identity research on gender.

Another article in the MERJ special issue was Parise (2021) who analyzed high school statistics textbooks and found that, when coding themes present in the books, heteronormativity was by far the prevailing theme driving the contexts and situations presented in the tasks. Examples of such heteronormativity she found were (1) conflation of gender and sex; (2) affirmation of gender binary structures; (3) rigid gender roles; and (4) heteronormative definitions of relationships.

The last paper in the MERJ special issue was Przybyla-Kuchek (2021) who suggested using feminist poststructural discourse analysis to perform gender research in mathematics education. She used this framework to analyze a seventh grade U.S. classroom and found that broader discourses about mathematics reflected gendered ways of being, which in turn produced subject positions for the girls. For example, this framework shows how much of the research I have surveyed in the present text is written from a White male perspective, framing the “disadvantaged” girls implicitly as “damsels in distress.”

7.1 Summary of The Fifth Epoch

The Fifth Epoch can be characterized as one that privileged contemporary theory and a turn away from empirical ways of studying gender and thinking about what gender is. This turn
included a characteristic embrace of more philosophical concepts, such as power and subjectivity. Researchers found evidence that pedagogical structures and relational interactions operate in gendered ways, and these results pushed the field towards a more materialist perspective on gender and its effects. Other researchers suggested that it may not be that women may not be underachieving, but that men may be overachieving; such results indicate that gender may have less to do with individual people, and more to do with the ways that gender structures and overdetermines social interactions between people. These suggestions have been supported by a recent turn towards neuroscience and the idea that gender may be operating in important ways that are outside of consciousness. Finally, in keeping with the materialist influences of this epoch, other investigations found that socioeconomic class and gender are more intricately intertwined that previously thought, apropos of mathematics achievement, whether that achievement be represented by course-taking or assessment trends.

8 Overall Summary of the Artifacts’ Speech

There are several themes which characterize research on gender in mathematics education, and these themes can roughly be organized into what I call “epochs.” The field started with the classic gender binary that was conflated with biological sex. From this, achievement was theorized along these binary lines, and achievement was seen in a monolithic dimension, in terms of standardized test achievement. From here, psychological variables were added to the analysis. Some researchers called for social factors to be added to the recipe. Over these epochs, these original theoretical calls were supported and expanded upon, and in some cases, they were confronted with contradictory results. In the last ten or so years, a new focus on critical, feminist-informed, and innovative qualitative methods has been raised, and it is from this place that I believe that the field will move forward—by using complex perspectives and a contemporary
viewpoint on how “gender” is far more dynamic and interconnected to other social dimensions than previously thought. Theory is important—the theoretical approach one takes in research predicates what results can be found in a set of data, and furthermore, theory reflects one’s engagement with (or disavowal of) ideology. More theoretical development is needed, and applications of existing theory need to be developed for specific use in mathematics education. It is my claim that psychoanalysis is one paradigm—currently unexplored with respect to gender and mathematics education—that holds such potential. It seems tenable that, in light of the marked difference of the Fifth Epoch and the contributions contained within it, that psychoanalysis is a warranted theoretical approach with which to take the next steps.

9 This Study is Only Thinkable Now: Psychoanalysis as the After-Science

This study critiques the ideological development of gender research in mathematics education over the past fifty years. As the present study will show, the overarching typification of the quilted-speech on gender in the field of mathematics education is primarily characterizable as scientific. While I will elaborate extensively on this in Chapters IV and V, it is important to note that Lacan in effect predicted this unfolding of events: specifically, I mean that the epoch of psychoanalytic discourse is only thinkable as an after-effect of the epoch of scientific discourse (see Lacan, 1974/1990, 1991/2007b). Extending this concept to speeches instead of discourses implicates the types of jouissance afforded by both paradigms. As described in Chapter I, scientific speeches are primarily characterizable by masculine jouissance whilst simultaneously disavowing that same jouissance; scientific speeches are able to disavow their inherent jouissance because they assume the existence of a metalanguage that would confer consistency onto the speech (by positing the “cogito,” the “I think”).57 In the case of psychoanalytic

57 The cogito is the ideological crystallization of the capitalist theory of the subject.
speeches, the existence of a metalanguage is rejected because the Big Other is itself Lacking (the “I do not think” effaces and is implicated in the “I think”): thus, the jouissance in psychoanalytic speech is both masculine (qua signification) and feminine (signification leads nowhere except to the traversal of phantasies, hence psychoanalytic signification is not evolutionistic). However, the goal of psychoanalytic speeches is to avow the jouissance necessarily contained within it, because psychoanalysis recognizes the limits of signification itself qua the role of the signifier to cause the emergence of what it does not signify, namely that of the (gendered) subject: “The signifier does not designate what is not there, it engenders it. What is not there, at the origin, is the subject itself” (Lacan, 1967/n.d.-b, p. 7). In other words, in scientific speeches, a metalanguage is assumed that would confer meaning onto the signifying chain, whereas in psychoanalytic speeches, the signifier only operates along a line of reference: the only stopping of the slippage that is possible is at the level of master-signifiers and privileged signifiers. These special cases themselves only refer to some material or ideological aspect, such as is the case with—for example—political economy (a master-signifier) and sexual difference (a privileged signifier).

For this reason, Lacan has said that psychoanalytic discourse is only thinkable as an after-effect of scientific discourses, insofar as psychoanalytic thought only emerged in the epoch of the symptoms of scientific speeches (see Lacan, 1974/1990, 1991/2007b). Science has posited the existence of the object, which has created a certain symptomatic effect, to which psychoanalysis offers a perspective on which to study those symptoms. For example, the scientific epoch has produced the signifier “woman,” which is a symptom of man’s phantasy, so it is only because of the intrusion of this signifier into the world that psychoanalysis posits the empty-signifier woman. In other words, science needed to exist first, to create symptoms, in order for
psychoanalysis to have something to do. Note that this is not a comment on the history of thought, for there can be no history of thought (Lacan, 2011/2018): there can only be a history of speeches—of what is written and what is not written.

Thus, this study is only thinkable at this point in the history of the field: the first fifty years, as I have just summarized, has been a history of scientific speeches. This history now gives rise to the necessity of a psychoanalysis of gender in mathematics education, which is precisely the task of the present study. In a way, I see the first fifty years of research on this topic as producing a paradox: that equity researchers do not actually want equity, because then there would be nothing to research or strive towards (see also Baldino & Cabral, 2006). However, this is perhaps inevitable, because—to draw on a Heidegger-inspired phrase—the paradox does not exist until it is spoken. In the psychoanalytic speech, the true is always-already false (Lacan, 1967/n.d.-b). In the context of gender research in mathematics education, researchers think their research identifies a universe of discourse on gender, but this cannot exist because no signifier can signify itself. Rather, what researchers are looking at is an attempt to stabilize sexual difference, to signify “woman” with a (−1). However, woman cannot be signified, because whatever master signifier might accomplish it would be phallic.

The symptoms of the first fifty years of gender research in mathematics education are precisely the contradictions elaborated in this chapter, that the research findings provided by the scientific speeches are incommensurable. Their contradictions are ideologically sublimated, because unconsciously, researchers are not bothered by them: instead, their contradictory findings form a semblance of a non-existent universe of discourse. Thus, the ideology of gender espouses that “everything is fine” without interrogating the desire of researchers who undertake

---

such work. Or, said another way, researchers’ unconscious are “good to go” insofar as the scientific speeches only legitimate a masculinization of women as it quilts subjects into them as “women.” As Lacan has said, “That is precisely the danger of [the scientific] logic. That logic is only supported where one can handle it in the use of writing, but that properly speaking, no one can be assured that someone who speaks of it is even saying something” (Lacan, 1967/n.d.-b, p. 39).

The mathematical identity-quilted-speech (Baldino & Cabral, 2018) of the woman (summarized in this chapter) does not happen without a masculinization of her sexual difference, of an attachment to the signifier I-am-a-woman decreed, as such, in the mathematics education context, so that she may participate and quilt. This is the paradox of “gender and mathematics” research: there is, in “women in mathematics,” a negation (in the Hegelian sense) of woman so that there is no paradox of saying “women in mathematics.”\(^{59}\) The scientific speeches are expressions of the conscience, which is a “con-science,” a science of persuading someone to do something, e.g., through evolutionism and interpellationism. Indeed, this speech has led to the result of its goal, as evidenced by the artifacts I analyze in the present study: “[W]e have been backed into [a corner of extreme, almost insane character] by something that is after all present in history, namely, the existence, indeed the insistence, of science” (Lacan, 1986/1992, p. 77, my emphasis). As a result of being in this corner, we have developed symptoms: symptoms caused by science. It is for this reason that, as Lacan predicted, psychoanalytic speech is only thinkable as an after of the scientific speech; hence, the present study is only thinkable now, at this point in the history of our field.

\(^{59}\) I elaborate on this further in Chapters IV and V.
10 Specific Research Question of This Study

In light of the preceding, recall my general research question from Chapter I: *What is it about mathematics that causes it to be such a potent social force in structuring gender, social, and economic relations?* I now refine this question, framing it in the context of a Lacanian ideology critique. Whatever may be the reasons that mathematics functions in a way such that it structures gender, social, and economic relations, the effects of mathematics in these regards are symptoms. The goal of psychoanalysis is to investigate symptoms *as such*, meaning that one looks for the reasons the symptoms may exist. As I have discussed, symptoms are also what tie psychoanalysis and ideological criticism together. Further, jouissance is the properly constitutive dimension of ideology (Žižek, 1989/2008a; 1994/2005; 2022), so that to perform a psychoanalytic ideology critique, jouissance is the fundamental dimension along which one must orient oneself. Thus, the “reasons” behind the symptoms captured in the general research question are reasons related to jouissance. For Lacan, there are two types of jouissance: masculine and feminine. As I have discussed, the primary characterization of mathematics education research on gender is generally orientable within masculine jouissance. This allows me to go beyond the generality of the general research question, specifying it in a way particular to Lacanian theory and ideological criticism. Thus, in order to critique the ideologies that constitute this overarching masculine jouissance, the specific research question of this study (which can be read as a “psychoanalysis version” of the general question) is: *What might a feminine quilted speech of mathematics be?*
CHAPTER III

THEORY AND METHODS FOR A LACANIAN IDEOLOGY CRITIQUE
III Theory and Methods for a Lacanian Ideology Critique

“Mathematics education research is [ideologically] formulated as a science of treatment that, by understanding the symptoms that characterize students’ learning difficulties in mathematics, aims at designing and applying proper treatments, with the hope of curing what is a defect in students’ learning.”

–(Pais, 2012, p. 53, emphasis added)

1 Theoretical Perspective: Lacanian Psychoanalysis

Psychoanalysis is a type of theory that acknowledges the existence of the unconscious (what has been called the “Freudian discovery”); as a result, it uses a conceptual and (methodo)logical framework that is very different from psychology. It has been described by a breadth of definitions as far-ranging as a science that understands itself through its own limits, not being a science at all, and an anti-psychology.

Psychoanalysis was a sort of “first psychiatry” before the advent of modern psychoactive medicines, although the two disciplines split into two distinct paradigms with the advent of those medicines. Because it is predicated on a speculative assumption (the existence of the unconscious), it is distinguished against positive psychology and other social or hard sciences. Margaret Walshaw, one of the original scholars to advance the application of psychoanalysis to mathematics education, said it concisely: “[P]sychoanalysis […] theorizes how the subject is at once fictional and real” (Walshaw, 2004, p. 127). It is this dialectical tension—simultaneous fiction and reality—that characterizes the psychoanalytic paradigm. Psychoanalysis uses theoretically universal structures of the human psyche to investigate and continuously
“subjectivize” its own knowledge production. Patricia Gherovici—a leading Lacanian gender theorist—has succinctly described the spirit of psychoanalytic methodology: “Let yourself be guided by psychoanalysis; each encounter reinvents it” (Patricia Gherovici, personal communication, March 4, 2021). This means that psychoanalysis positions itself methodologically against a pre-set procedure, instead heralding a continuously re-emergent process of “becoming”-a-psychoanalyst. As a result, psychoanalysis as a methodology (while maintaining some typical tools or tricks, such as scansion and punctuation during an analytic session with an analysand) can be said to—more accurately—reflect an immersive modus operandi by each psychoanalytic thinker, wherein their overall worldview is shaped and re-shaped by psychoanalytic thought and encounters. In other words, the end-game of psychoanalysis would be that everyone becomes analysts themselves.

Through a reinventive theorizing of the unconscious, repetition, transference, and drive—what Lacan (1973/1981) has called The Four Fundamental Concepts of Psychoanalysis—new psychoanalytic thinking emerges out of practitioners’ and theorists’ psychoanalytic encounters both inside and outside the clinic. As a result, psychoanalysis as a methodology can be applied to any analysand that one wishes—an individual, an institution, a social ideology, and so forth. In short, “what counts as psychoanalysis” (Tupinambá, 2021, p. 86) can be considered a collection of declarations about psychoanalytic concepts—made by either the particularity of the analysand or the conceptuality of the analyst—so that psychoanalysis as a methodology can be reflexively defined as exercises in psychoanalytic thinking. As a result, psychoanalytic literature (including all of Lacan’s work) may appear to the outside reader as talking “around” concepts rather than saying what they are. This is for good reason though: the more prescriptive conceptual commitments enter psychoanalysis, the less flexible it is to being reinvented with each encounter.
Rather, if we privilege descriptive conceptual commitments, they can then be re-described (through exercises in psychoanalytic thinking) and re-described and re-described and re-described and …

I will proceed next by giving possible brief descriptions of some Lacanian concepts that are germane to the present dissertation. Further use and application of these concepts will be employed in the subsequent analysis chapter. I use the following subsections as brief referential descriptions to the concepts, and notwithstanding the analysis itself, more concepts will be quilted later. The descriptions here are not meant to be exhaustive; they are only explicated insofar as they are germane to the quilting of my speech in this study.

1.1 Imaginary, Symbolic, Real, Sinthome

The psyche is structured in four realms. The first is the Imaginary, which is the register of the ego’s projection onto the world of vorstellungen (idea-representations), which relate to how the subject wishes to represent himself. The Symbolic is the universal policeman, conferring agency and sensor onto the subject through systems such as language and law. The Real is the concomitant obscene inverse of the Symbolic; the Symbolic is always-already inconsistent and the Real is its traumatic complement, that which cannot be Symbolized. Confrontation with the Real can lead to the emergence of a symptom in the Symbolic. The sinthome is a special type of symptom that Lacan added later in his teaching, characterizing it as a symptom that makes life livable and thus does not need to be cured; it is a way of the subject enjoying his unconscious.

1.2 There is No A Priori Human-Being

For Lacan, there is no a priori human-being, there is only the a priori social link. The human subject-position is produced by language. When the baby (S) enters into language, they
hypnopompically hypnopompic imposition by the Big Other becomes a sort of prototype for the social link: neither the baby nor the Big Other are whole (Žižek, 2008a), creating a split in the psyche of the baby which continues throughout life. It is from this position of the split-self that the baby speaks “from” the Big Other “to” no one in particular (Lacan, 2004/2014).

1.3 The Formulas of Sexuation

Lacan (1975/1998) structures the masculine and the feminine positions in what he called the Formulas of Sexuation. In this arrangement, the masculine position is that all men are castrated because there exists one that isn’t, and the feminine position is the empty signifier that interrogates the phallic structure because there does not exist a woman that isn’t phallic. The masculine position is the barred subject who phantasizes about objet a, the object cause of masculine desire: the desire to signify. The feminine position, meanwhile, asks the phallic masculine position, “Who is this that you are trying for me to be?”

The Formulas of Sexuation are not to be confused with biology, anatomy, or categorical gender. Rather, they describe the logic of psychosexual organization, describing positions that “orient how the subject becomes embodied [as a sexed subject, or not]” (Patricia Gherovici, December 2, 2022, personal communication). In other words, the Formulas of Sexuation thus describe a logic of gendered becoming that “goes against any attempt at classification, and even against the binary nature under which the formulas [of Sexuation] may at first appear to be organized” (Morel, 2023, p. 111). In this way, the Formulas of Sexuation are a foundational tool

---

60 Hypnopompic refers to the state immediately before waking from sleep (see Lacan, 2004/2014).
for psychoanalytic thinkers in understanding and undoing the ways in which human beings, *qua* social beings, become gendered through language and ideology.\(^{61}\)

### 1.4 Che Vuoi?

This famous Italian saying means “what do you want [from me]?” and describes the dialectic of the subject’s interactions with the Big Other and with other subjects. It characterizes that one’s own desire is always the desire of the Other. However, since both the subject and the Other are always—already imbued with Lack, this desire is elusive. The “phenomenon” we typically call learning, then, is inextricably linked to the “noumenon” of desiring knowledge—specifically, knowledge of *jouissance*. The Symbolic of the educational institution is thus confronted with the Real of the enjoyment of the knowledge it psychotically imposes on students, and the student experiences the learning environment as a pathological encounter (Moore, forthcoming). The student asks the teacher “che vuoi?” and the Symbolic teacher, from the position of the Master, speaks a psychotic statement back to the student. For both, the subject sacrifices some of his desire in order to engage in the Symbolic conformity of the social link.

### 2 The Symptom: Psychoanalysis, Ideological Criticism, and Mathematics/Education

Following Žižek (e.g., 1989/2008a), I link the relevance of psychoanalysis to ideological criticism through the notion of the *symptom*. In this section, I describe this alignment. I inscribe the signifier “mathematics education” as “mathematics/education” in order to tease apart the signifying chain in an attempt to at least partially arrest the slippage of the signifier “mathematics education.”

---

\(^{61}\) In general throughout this dissertation, my use of the signifier “ideology” should also be understood within the context of my perspective as an ideological critic, in that ideology encompasses society and society encompasses culture. Lacan (1975/1998) has said, “Culture, insofar as it is distinct from society, doesn’t exist. Culture is the fact that it has a hold on us” (pp. 53–54). Furthermore, “Society is just a euphemism for ideology” (Roberto R. Baldino, November 19, 2021, personal communication). Therefore, my use of the signifier “ideology” should be read as subsuming both the signifiers “culture” and “society.”
Mathematics is a language of pure signifiers using pure Symbolization and thus represents a peculiar and psychically unique educational content that plays a specific role in the advancement of gender-equity discourses in educational research. The violent and negative reactions (see, for example, Moore, 2021) to equity research confirm the role of the Symbolic (to which mathematics belongs in the institutional ideology of education) in structuring society’s ideological engagement with agendas of educational “progress.” In psychic reality, mathematics is a larger function of the obscene and traumatic inverse of the Symbolic—viz. the Real (Matthews, 2020; Moore, 2022). Thus, mathematics education specifically is a critical cornerstone in the larger interrogation by educational researchers interested in engaging with equity research (see also, e.g., Lubienski & Ataide Pinheiro, 2020).

Symptoms are Symbolic, the products of Symbolic overdetermination (Žižek, 2008a) of the Real split-subject; gender insofar as it is a symptom (Gherovici, 2017) is psychically inseparable from the Symbolic overdetermination of mathematics carried out by the capitalist mode of school (Moore, 2022). Investigating a symptom, whether it is the violent reactions against gender transgression (e.g., the transgender epoch) or the violent reactions against proposed rejections of the capitalist-Symbolic mode of mathematics education (e.g., “2+2=5”), means interrogating its Symbolic core and is thus the crux of psychoanalytic practice and also of this dissertation. In both cases, these are ideological foreclosures of the Real and thus are existential antagonisms. The ideologies—employed in the production of gender and mathematics research—that I reject in this dissertation Symbolically overdetermine both the nature of gender and the nature of mathematics. If researchers were interested in interrogating both of these symptoms, rather than pursuing gender-equity research under the ideologies I critique herein, then both symptoms would reach the point of their dissolution. Affected subjects’ verbalization
of their symptoms dissolves them; they are only sustained by a certain non-knowledge on the part of subjects so they may enjoy them (Žižek, 2008a). Gender equity researchers must therefore confront their own enjoyment of gender in order to recognize it as a symptom of existential representation of the self (Gherovici, 2017) and nothing more. In this way, what I offer in this study is a quilted-speech that represents a statute of statements aimed at assisting this confrontation.

3 Hegelian/Speculative Logic

In this study, I rely on a logic that is non-traditional in the field of mathematics education. Hegel (e.g., 2010) contributed greatly to the development of non-traditional logic, namely through his *Science of Logic* and *Encyclopedia Logic* that develop a logical basis for speculation. In this logical system, which has contributed recently to the mathematical logic of quantum mechanics (e.g., Žižek, 2017), *being* and *nothing* are strictly and immediately correlative. As a result of this immediate contradiction, *speculation* is the only logical operator on which arguments can be advanced. While incommensurable with traditional/deductive scientific logics, the failure of these logics in coping with the contradictions of science at the quantum level is, for a Hegelian approach, also universal. In other words, in Hegelian/speculative logic, not only are contradictions tenable, they are also expected. Lacan (1967/n.d.-b), in his *Seminar XIV: The Logic of Phantasy*, has also shown how, when studying the unconscious, traditional logical operators fail.

The necessity of employing Hegelian logic in the study of the “human” interface with mathematics is not only limited to quantum mechanics. Recent advances by feminists in artificial intelligence and machine learning—what might be considered the “most human adjacent” form of mathematical application—have also elucidated the necessity of a logic based on dialectics,
parthood, and opposition; Mani (2017) explicates that the necessary logic for this task is
Hegelian and Marxist. In other words, whether it is the foundation of the universe (viz. quantum
mechanics) or the semblance-accession of humanoid mathematics (viz. artificial intelligence),
speculative logic is a necessary basis. Thus, the adoption of Hegelian/speculative logic for the
present study is philosophically appropriate. Furthermore, Žižek (e.g., 2012) has developed an
extensive argument to align Hegelian logic with Lacanian psychoanalysis when read through
Marx’s critique of ideology and political economy. Lacan was greatly influenced by Kojève’s
lectures on Hegel’s logic, and so this alignment has been well documented in the literature. In the
present study, I adopt this position. A quick Lacanian gloss of this logic, apropos of the
unconscious, would yield a statement such as: “I know more than I know,” which is indeed the
effect of ideology. Thus, the apparent incommensurability of the present study with the literature
that I critique should not be read as incommensurability, but rather as a contradiction: the
existing literature is the being, and the present study is the nothing—or vice versa; but in either
case, the contradiction is precisely its unity. It is from this unity that I am “integrating the
Otherness” of the present study with the literature I critique; this is, in short, the insight of
Hegelian logic.

Further, Hegel’s notion of concrete universality necessitates that I compare the literature’s
quilted-speech (Chapter II) with its own concrete content (Chapter IV). I show in Chapter IV
how the hysterics of “gender and mathematics research” reveal a disavowal of gender acting as an
agent at the heart of the capitalist mode of school: in this way, “gender equity” does not
actually seek gender equity, but rather seeks more exclusion, the reality of which it must
sublimate. Why is this? Elsewhere (Moore, forthcoming), I have argued that one of mathematics’
functions in modernity is as *Das Ding*, insofar as mathematics can be said to suffer from our excess signification (see Lacan, 1986/1992), thus causing mathematics to appear to us in a suffering-state. However, the Lacanian insight apropos of *Das Ding* is that it is both Lacking and Universal, insofar as it stands in for what we are Lacking: Universality. But this insight goes one step further: in light of concrete universality, if mathematics is *Das Ding*, then the psychic consequences of mathematics lend further credence to Sohn-Rethel’s (1978) claim that mathematics is a consequence of materiality, because it is in the body (which is the material of the Big Other; Lacan, 1967/n.d.-b) that concrete universality’s fracturing effect is “felt” qua the mathematical Real. The only true concrete universal is that of Capital which functions at the level of the master-signifier (Lacan, 1991/2007b; Žizek, 2018): in other words, a Hegelian interpretation of concrete universality in the context of discourses of mathematics education is that economy overdetermines all other equity discourses.

For this reason, the enterprise of mathematics education is interested only in more signification, more excess of the Symbolic—this only leads to more symptomatic exclusion vis-à-vis more masculine-quilted-speech. It is this masculine-quilted-speech that—in the capitalist mode of school in modernity—is always-already the referent for any equity discourses, that the women and girls are only considered to be benefitting from “more equitable” learning outcomes when referenced against the masculine position of signification. It is the intention (and result) of

---

62 *Das Ding* (The Thing) is the primordial non-object for which the subject searches (see Lacan 1986/1992). It is not an “absent object,” it is that it is “not.” As a result, the search for it must “go around it” (Lacan, 1986/1998, p. 95). It is characterized by its strangeness, by its characteristic of being the “beyond-of-the-signified” (Lacan, 1986/1992, p. 54). If we actually found *Das Ding*, signification would be obliterated. For this reason, Lacan (1986/1992) describes *Das Ding* as “that which in the Real… suffers from the signifier” (p. 118). *Das Ding* is foundational to the discourse of science, because “[t]he discourse of science repudiates the presence of the Thing insofar as from its point of view the ideal of absolute knowledge is glimpsed, that is, something that posits the Thing while it pays no attention to it” (Lacan, 1986/1992, p. 131). This means that scientific discourse is a neurotic speech. This is an important concept that connects the quilted-speech of the artifacts analyzed in the present study and the enjoyment that their speech contains. I expand on this in Chapter IV.
the capitalist mode of mathematics education to yield this masculine-quilted-speech as the only enduring and valid answer to the question, “What is the point of all this mathematics education?”

Or, as stated by Pais (2011), “No matter how prosaic and emancipatory the discourse [for example, the discourse on gender equity] may sound, when actualized in schools, it ends up being adjusted to the logic of school accreditation” (pp. 54–55), which is the logic of the capitalist mode of school.

4 Methodology: Ideological Criticism

Ideological criticism is a method of rhetorical criticism that focuses on ideological analysis of an artifact, elucidating what the artifact suggests as filtered through the ideology that created it (Foss, 2018). Before describing the methodology of ideological criticism, I wish to posit a definition of ideology—specifically, Žižek’s (1989/2008a) definition which itself draws on the Marxist definition previously mentioned (Marx & Engles, 1846/1968) by connecting it to psychoanalysis through the notion of the symptom:

[I]deology is not simply a false consciousness, an illusory representation of reality, it is rather this reality itself which is already to be conceived as ‘ideological’—‘ideological’ [sic] is a social reality whose very existence implies the non-knowledge of its participants as to its essence—that is, [it is] the social effectivity[,] the very reproduction of which implies that the individuals ‘do not know what they are doing.’ ‘Ideological’ is not the ‘false consciousness’ of a (social) being but this being itself insofar as it is supported by ‘false consciousness.’ Thus we have finally reached the dimension of the symptom, because one of its possible definitions would also be a ‘formation whose very consistency implies a certain non-knowledge on the part of the subject’: the subject can ‘enjoy his
symptom’ only insofar as its logic escapes him—the measure of the success of its interpretation is precisely its dissolution. (Žižek, 2008a, pp. 15–16)

In other words, via the symptom, ideology functions today as a differential system between what people say and what people do (Žižek, 2008c). Or, as Pais (2013) puts it: “[A] critique of ideology seeks not so much to disclose the ‘ideology’ corrupting our practices but to show how our practices [emphasis added] form the necessary support for this same ‘ideology’” (p. 29). This is precisely what I shall do in the present dissertation.

Further, the less one knows why they have a certain symptom, the more they can enjoy it, a process that eventually raises ideology to the status of a sublime object (Lacan, 1986/1992; Žižek, 2008a). Here, a “sublime object” means some thing (as Lacan would say, a semblance of what is literally “Das Ding,” The Thing, the primordial non-object) that has been sublimated (buried under excess signification to hide its “thing-ness”) to an extreme degree. The more one sublimates something, the more they enjoy it; this even includes ideology. The more ideology is sublimated—meaning made more socially acceptable, less ‘ideological,’ and raised to the dignified level of the sublime—the more enjoyment can be had from that ideology. And further, this enjoyment is observable in the forms of symptoms that are produced, whether by actors or institutions. In the case of mathematics education, either can be the case.

Rhetorical criticism, generally, is a family of methodologies that analyze and critique rhetorical devices (viz. acts and artifacts) as being created by humans, using symbols, with the purpose of communicating (Foss, 2018). All types of criticism within this family generally follow the basic approach that (1) an act or artifact is selected, (2) the act or artifact is analyzed with particular reference to a critical slant, (3) a research question is formulated at the end of the analysis, and (4) the research question is attempted to be answered by the researcher in the vein
of “What does the act or artifact suggest?” Ideological criticism is one methodological variant of rhetorical criticism. Thus, an ideological critic “looks beyond the surface structure of an artifact to discover the beliefs, values, and assumptions it suggests” (Foss, 2018, p. 237). Foss is quick to note that ideology is not the same as a personal expressive desire (e.g., “I don’t like this car”), but that, rather, ideologies are “composed of evaluative beliefs—beliefs about which there are possible alternative judgments” (Foss, 2018, p. 237). Furthermore, ideologies “highlight particular positions on social issues, [and ideological statements] are likely to communicate group beliefs […] by] control[ing] and coordinat[ing] the actions of those who adhere to them” (Foss, 2018, pp. 237–238). For this reason, the ideological critic’s goal is to “discover and make visible the ideology embedded in an artifact” and to “explicate the role of communication in creating and sustaining an ideology and to discover whose interests are represented in that ideology” (Foss, 2018, p. 242).

In an ideological analysis, the critic first selects an artifact. The artifact can be anything, and in the case of mathematics education, the most common types of artifacts come from the published literature—journal articles, institutional reports or guidelines, and so forth. Because ideologies are everywhere, every artifact has been produced through the lens of some ideology: “Every artifact takes an evaluative position on various subjects simply by the rhetorical choices that the rhetor made in creating that artifact” (Foss, 2018, p. 242). The situation becomes complicated because ideologies operate at both conscious and unconscious levels, with the result that key aspects of them become repressed, reappearing as symptoms. This occurrence is evidenced by the existence of multiple ideologies, with some becoming “the dominant way[s] of seeing the world [or developing into hegemonies]” (Foss, 2018, p. 239). This is precisely the point of departure for most ideological critics, because in hegemonic situations, an ideology
“invites ‘us to understand the world in certain ways, but not others’” (O’Connor & Downing, 1990, as cited in Foss, 2018, p. 239) by “accumulat[ing] ‘the symbolic power to map or classify the world for others’” (Hall, 1988, as cited in Foss, 2018, p. 239).

6 Methods

In light of the preceding, in this section I describe the methods undertaken in the present study in order to perform the analyses of the artifacts. For each artifact, the following method steps will be taken, drawing on the methods outlined by Foss (2018):

1) Identify Presented Ideological Elements:
   a. Read the artifact.
   b. Seek to “identify the assumptions, presuppositions, or premises behind the artifact that constitute its ideology” (Foss, 2018, p. 243, my emphasis). In addition, I will seek to identify the purpose/function of the artifact, whether stated or implicit.
   c. Look for “individual signs [or observable features] that point to ideological tenets in the artifact, working back to the often implicit ideology through the rhetorical content and form of the artifact” (Foss, 2018, p. 243, my emphasis).
   d. For example, instances of these might include “major arguments, types of evidence, particular terms, or metaphors” (Foss, 2018, p. 243).

2) Identify Suggested Ideological Elements:
   a. There are two types of suggested ideological elements that will be considered, which, taken together, represent the ideological position of Lacanian political psychoanalysis (the reference position for the present study).
b. Those reflecting the psychoanalytic dimension (e.g., social, relational, or unconscious): what is *actually said* in the artifact regarding gender that is incommensurable with Lacanian theory (e.g., Lacan, 1975/1998).

c. Those reflecting a Marxist dimension (e.g., political or economic): a *material* arrangement that is grasped and presented as an *ideal* in the artifact (e.g., Marx & Engles, 1846/1968).

d. As previously explained, the Lacanian and Marxist dimensions will often conflate; in cases such as this, both dimensions will be elaborated in the analysis of the artifact with respect to their particular origins and ideological implications.

e. This step will include stating what the psychoanalytic and/or materialist *purpose/function* of the article might be.

3) **Formulate:**

   a. Re-read the artifact, considering the ideological positions identified in Steps 1 and 2. Begin to formulate an ideological characterization of the artifact. This may take a sentence or a paragraph to accomplish, but the overall ideological characterization will be written with respect to the reference ideological position of the present study, viz. Lacanian political psychoanalysis.

4) **Record Results:**

   a. Record and synthesize the results of Steps 1, 2 and 3 for each artifact into a writeup of an ideological critique of each artifact. (I mostly did this in the margins of the artifacts as I read and reread them.)

5) **Consider Thinning the Sample:**
a. Repeat this process for several selected artifacts at first, specifically, artifacts that serve as *ideological exemplars*, those artifacts that are:

i. Particularly ideologically dense, and

ii. Most highly cited.

b. Decide if more artifacts are needed, or if they can be grouped in with others or discarded.

c. This process resulted in Steps 1–4 being conducted on 25 of the 178 artifacts, with artifacts being selected from each of the “epochs” in Chapter II.
CHAPTER IV

THE IDEOLOGY CRITIQUE
IV The Ideology Critique

“For their benefit, I oppose truth and knowledge… I insist on finding my range with a knowledge in failure… not the failure of knowledge. … I learn, then, that one believes to be relieved from having to give proof of any knowledge. … [Biology] already gives itself everything from the very start: … it overtakes ideology in blessing itself with being natural. … Nonetheless, natural science finds itself… being brought back to the consideration of the symptom in facts. … Truth reinforces in [itself] the structure of fiction[.]”


In this chapter, I perform the ideology critiques of the selected subset of artifacts (N=25). The artifacts selected were chosen for their ideological “exemplification.” Reading the articles as a total corpus, several ideologies were, what I shall call grand ideologies.

These include the ideologies of:

- Scientism: The belief that objectivity, deductive logic, and positivism are requisite for knowing (this ideology is a concept in the public domain).

- Solutionism: The belief that “the data says it all” because the pragmatism of the real world is inherently unideological; thus, the application of mathematics to issues necessarily leads to a better world (Morozov, 2013).

- Evolutionism: The belief in a greater good as the end result of an intervention; unbeknownst to the subject, this ideology is one that pre-structures their actions from the very beginning (Lacan, 1986/1992).
• Neoliberalism: The belief that one has potential and is able to pursue it through persistence for success (this ideology is a concept in the public domain).

• Postmodernism: Postmodernism is the belief that local metanarratives exist without overdetermining global metanarratives, which allows for issues of equity to be conceived of in terms of specificities and specific identities (this ideology is a concept in the public domain; also see Pais, 2012, 2014, 2016, 2019). However, within the ideology critique frame I employ in the present study, this ideology is a cause because Capital is (despite postmodernism’s desires otherwise) still the only concrete universal. Capital is the master-signifier that overdetermines all other struggles.

Over and above these grand ideologies, I have introduced the notion of interpellationism (see Chapter I). Here, I provide a brief description of each of the grand ideologies; these describe the “general” ideological character of the entire corpus surveyed in Chapter II. After providing these descriptions, I historicize each epoch and then critique each artifact of the selected subset in subsequent sections. The selected subset of artifacts represents a sampling of each epoch, and the epoch of each artifact is noted in the section headings.

1 Brief Descriptions of the Grand Ideologies

1.1 The Scientific Ideology

Scientific ideology (scientism) can be characterized by a privileging of objectivity, deductive logic, and positivism—in other words, the knowable is the quantifiable and measurable. Knowledge is judged for its compliance and coherence within these values and with respect to previously produced knowledge. The modes of investigation for the scientific ideology include a belief in observation, the belief in measurement, and the belief in the universality of
scientific claims. In the case of gender and mathematics education, the scientific ideology avows that gender is a scientific—and thus measurable—dimension, and that, thus, its measurements can be correlated, regressed, and mathematically connected to other dimensions. Scientism is closely related to Solutionism, which is an ideology recently identified and developed by Belarusian American researcher Evgeny Morozov. In his (2013) book *To Save Everything, Click Here*, he develops the notion that the *data says it all*. Basing his critique in critical science and technology studies, Morozov quotes Google CEO Eric Schmidt and puts it succinctly:

“Technology is about collecting and analyzing enormous amounts of data in order to change the world for the better” (Eric Schmidt, as cited in Morozov, 2013, p. 9). While Schmidt was not specifically talking about mathematics education, solutionism is germane to the present study insofar as it captures the ideological essence of large-scale quantitative studies on equity in our field: “Solutionism paints itself in the colours of a completely unideological, pragmatic realism” (Straehler-Pohl, 2016, p. 3). As Žižek (1989/2008a) elucidates, this is the most ideological position one can take: to believe that there is no ideology in their position. By operating along the lines of solutionism, large-scale quantitative studies—which collect and analyze enormous amounts of data—attempt to waive complex social analysis in the name of the “moral horizon” of creating a better, more equitable world (Straehler-Pohl, 2016).

### 1.2 The Evolutionist Ideology

Evolutionist ideology (evolutionism) is an ideology developed by Lacan (1986/1992) in *Seminar VII: The Ethics of Psychoanalysis*. Evolutionism is the ideological belief that one’s actions (for example, as a researcher) are guided by a supreme or sovereign good as the end goal, and that the inherent “goodness” of this end goal is what motivates and delineates all of one’s actions and decisions in leading up to that goal. In the case of mathematics education, this
ideology has been succinctly described by Straehler-Pohl and Pais (2014): “[T]he supreme goal [of mathematics education] is ‘mathematics for all’ … [which prefigures research as being aimed at] eliminating the obstacles standing in the way of this goal” (p. 80). A key indicator of evolutionism being present in the work of the field of mathematics education is evidenced by the fact that, “[This goal of eliminating obstacles in the way of achieving ‘equitable’ mathematics education] is seldom questioned… [which causes] the discourse on equity [to end] up functioning as a regulative ideal rather than an empirically realizable event” (Straehler-Pohl & Pais, 2014, p. 80, emphasis in original). In terms of ideology, it is important to note here that Straehler-Pohl and Pais indicate how the material is taken as an ideal, with the ideal being surreptitiously employed as a material regulation: this is akin to the Marxist definition of what causes ideology to propagate. Thus, evolutionism is an exemplar in terms of capitalist ideological motives, particularly when critiquing research on equity in our field.

1.3 The Neoliberal Ideology

Neoliberal ideology (neoliberalism) can be characterized by a privileging of individual potentiality. Neoliberalism is the ideology that props up capitalism, for it is necessary for laborers to believe that through the achievement of their individual potentiality, they are capitalists too. Within the capitalist mode of school, neoliberal ideology avows students’ individual potentiality for success. Crucially, this potential for success is only qualified against the institution’s definition of success itself. The effect of neoliberal ideology is a foreclosure of alternate ways of knowing, learning, experiencing, and being. Consider a counterexample to the neoliberal ideology in school: if there was no assessment, there would be no neoliberal goal of success. However, in the capitalist mode of school, students have no choice but to succeed through the production of a singular type of labor-power (Baldino & Cabral, 2013, 2015; Cabral
& Baldino, 2019). If, instead, we had a communal or anarchist mode of school, traditional individual assessment (an economy of goods) would be replaced by an ethical doctrine of the economy of Goods (see Lacan, 1986/1992). As a result, material labor would be the only “assessable” dimension of school (e.g., Baldino & Cabral, 2021). In many ways, the Indigenous turn in education research currently emerging disavows the “sovereign Good” of Aristotelian logic and thus more supportive of a rejection of the capitalist mode of school which is, in turn, supported by neoliberal ideology.

Sohn-Rethel (1978), following Marx, argues that the material determines the ideal and thus also the ideological; he includes in this argument that mathematical ideas are themselves determined by materiality (see also Pais, 2019). Sohn-Rethel and Marx show that, similar to the way that ideology is produced, institutionalized mathematics (what I would like to call the “ideality of mathematics”) is in fact a product of material conditions—viz. labor and the relations of production (Pais, 2014, 2019). Thus, institutionalized mathematics is an ideal, and further, is an idealistic grasping and disavowal of the materiality that produced it over history. This reveals why ideology critique is important for the field of mathematics education research to consider: since “the Real of class antagonism [is] the disavowed core of ideological fantasy” (Vighi & Feldner, 2007, p. 141), it is this Real of class antagonism that is also the point-de-capitons of the installation of institutionalized/school mathematics, which is an “idealized” mathematics. In other words, if “Real” mathematics is material, and institutionalized mathematics is ideal, it is in the gap between them that the work of ideology can be seen.

This leads to a particularly large issue for one ideology in particular: neoliberalism. Neoliberalism is not just about the psychological dimensions of “achievement” and the like, it refers specifically to one type of achievement: that of becoming homo economicus, meaning that
neoliberalism is the ideology that the “individual’s job is to maximize [theirself] into a market mentality in order to become the ideal being” (Marcus Weaver-Hightower, personal communication, August 24, 2023). Here again is evidenced the gap between the material and the ideal: neoliberalism posits individual achievement, but its goal is to efface this ideal individual by disavowing that the ideal individual’s achievement is specifically to become the perfect material cog in the market (see also Harvey, 2005). Through this ideological mechanism, the market policies of the 1980s (e.g., the Second Epoch) were only to be possible with the help of a writ broad neoliberal push. In other words, neoliberalism works so effectively by tricking individuals into thinking it’s all about their individual achievement, but this fallacy hides the fact that their achievement is singular: it is about the market, not the individual. Thus, “achievement” in the neoliberal sense roughly means achieving the perfect market through the potential to “market-maximize” individual people by transforming them—through ideology—into economic cogs so that the market itself can be maximized. Sohn-Rethel’s (1978) argument comes into direct play apropos of the field of mathematics education research: institutional/school mathematics assists greatly in this production of homo economicus. Neoliberalism enables students to become ideal homo economicus individuals under the banner of “individual achievement” in school/institutional mathematics.

1.4 The Postmodern Ideology

Postmodern ideology (postmodernism) can be characterized by a privileging of local metanarratives over global metanarratives. In postmodernism, it is necessary that one rejects a belief in master structuring narratives, instead claiming that local narratives explain much more about the human experience and endeavor. This interpretation of modernity and postmodernity

---

63 I am grateful to Dr. Marcus Weaver-Hightower for this phrasing.
may seem controversial, however it is my theoretical position that class struggle is the only universal position, whilst other struggles are symptoms of class struggle (also see Žižek, 1989/2008a). This is an orthodox Marxist interpretation of the world, but one which I still believe to be true. This interpretation is upheld by a large swath of transnational and Marxist feminist thought. The postmodern ideology, in this framing, is nothing other than an ideology that creates proxy metanarratives as distractions from class struggle.

2 Historicizing and Ideologically Characterizing the Epochs

In this section, I provide a historical context for each of the epochs, describing the political and ideological influences from each epoch in order to better situate the ideology critiques of the artifacts in subsequent sections of this chapter. These sections contain overall ideological critiques of the respective epochs, which assist in situating the individual critiques.

2.1 The First Epoch

The overall ideological character of the First Epoch consisted of scientism, especially apropos of the biological arguments and also the turn towards the social factors hypotheses, which in this epoch were largely being measured using quantitative methods. Additional ideological influence came from the evolutionistic enthusiasm that accompanied the de facto creation of the field of mathematics education. Finally, neoliberal influences were also characteristic of this epoch, as evidenced by the widespread focus on achievement. Next, I elaborate these characteristics from their historical context.

The transition of the 1970s to the 1980s in American education was a particularly charged time. The 1970s saw US culture engaged in critical thinking and rejection of previous ways of knowing about social issues. In particular, the 1960s and 1970s saw increasing federal government involvement in public education, with the passage of laws that sought to at least
partially arrest inequality that had become salient in the context of schooling; this brought forth a social shift of the notion of “equality” to the notion of “equity” whereby opportunities for positive educational outcomes were beginning to be seen as complex (McMeekin & Dede, 1980). The 1960s Civil Rights Movement in the US marked the “beginning of the end” of the American experiment by revealing the county’s absence of faith in a common goal and democratic ideals. In fact, it was the mid-1960s that replaced the dream of American democracy with the global rule of American Militaristic Exceptionalism (Jay Watkins, April 28, 2023, personal communication), by creating proxy military rule across the world in order to galvanize the unraveling of the American system at home.64 In the late 1960s, the end of the Vietnam War—which was itself a major factor in leading to the “hippie”/”enjoy-whatever-if-it-feels-good” movement—led to a general distrust in the government, especially amongst liberal and progressive circles. The general feeling that the government would “do whatever they wanted” without listening to the people led to a hopelessness about the future, which was concurrent with the Civil Rights Movement: in both cases, there was a *writ broad* failure of Americans’ faith in the American Dream. This led to, by the mid-1970s, a resurgence on all fronts of American society of neoliberalism and neoconservatism (the latter, I roughly equate to Evolutionistic ideology; Lacan, 1986/1992; see Chapter IV). The general impact of this was that the federal government began to assert a position that they know what is best, in order to address the concerns of the growing popular resentment towards the government, a resentment which, if left unaddressed by the government, would have sealed the certain fate of the American experiment. The federal government, itself galvanized by the surge of neoliberal and evolutionistic thought, realized their role in re-ascertaining a new American goal for education in the 1980s: that of

---

64 Dr. Jerry T. “Jay” Watkins, III, is a history professor and friend of mine, who focuses on queer and Marxist accounts of American history.
federal oversight, congressional policy to drive educational decisions, and both of these as being overdetermined by empirical ways of knowing related to “improvement” and “achievement.”

By the end of the 1970s, this trend culminated with the formation of the first-ever federal Department of Education in the US in 1980, which itself can be seen as a symptom of these cultural evolutions. This newly formed department, charged with federal oversight and influence on each state’s schooling system, would demarcate a watershed moment in the unfolding of American education’s history by forever changing the role of the federal government in the institution that is fundamentally concerned with social reproduction: what they called the mandate of equity and quality; these are ideologically loaded signifiers that were in no part apolitical or innocuous, primarily because this mandate was concurrent with a surge in neoliberal (i.e., conservatism and its rejection of increased taxation to support social programs such as school) popular sentiment. In other words, the federal government, at the end of the First Epoch, became the delineating factor in what would become the Second Epoch and epochs hence. Here, a two-fold effect can be seen: on the one hand, with the formation of the federal Department of Education and the election of President Ronald Reagan in 1980, we see the federal government begin its full-blown support of neoliberal ideology, which would ultimately prove to be one of the major undoing factors in the world order and the rapid acceleration of capitalism into late capitalism. On the other hand, we see a federal mandate of education being approached from the level of “equitable opportunity for achievement,” a mandate which codified the concerns of American education as being empirical in nature and thus could be solved with empirical mechanisms (McMeekin & Dede, 1980), such as with data generated from standardized testing and comparing such data against lines of social groups. In both cases, the increasing fetishistic approach to “minority groups” opportunities for achievement in education retained the hidden
referent of the dominant, White, suburban, middle-class standards. For example, the increasing concern during this time of “equity” and “quality” was caused by the “White Flight” phenomenon that massively redistributed racial groups into geographic areas, such as People of Color inhabiting the inner cities, and Whites inhabiting the suburbs (McMeekin & Dede, 1980).

The dogmatic embrace of neoliberalism vis-à-vis Reagan’s economic and social policies also served in many ways to bolster American competition with Communist countries (McMeekin & Dede, 1980), which, in turn, led to a reactionary rejection of those same influences in the form of the complexified sociological trends of the Second Epoch; the creation of the Department of Education led to the dominance of the empirico-psychological trend in the Second Epoch. The critical culture of the 1970s, a salient encounter with the Real that was caused by a decade of American Militaristic Exceptionalism, led to the development of a new symptom in American education: the US’s doubling-down on neoliberal market policies and supposing that they could be used to account for a particular (and ideological) conception of “improvement” and “achievement” in schooling: namely that of empiricism. This sets the stage for the trends of the Second Epoch.

2.2 The Second Epoch

The overall ideological character of the Second Epoch consisted of a continued interest in scientism, through the development of more advanced quantitative methods such as structural equation modeling. This expanded interest in quantitative ways of knowing indicates the epoch’s solutionistic character, in that the application of more sophisticated quantitative techniques would lead to valued insights. The neoliberal influence continued during this period as well, with continued focus on achievement. Finally, this epoch included influences from the beginnings of postmodern ideology, as this ideology was being developed in its own right during the same time
period and was increasingly influencing academic research broadly. Next, I elaborate these characteristics from their historical context.

One of the most salient delineators of the Second Epoch was the publication of *A Nation at Risk* (Gardner et al., 1983). The report summarized the weakening US position amongst the world powers, and equated the trend towards globalization with continuously lowered test scores relating to academic achievement in school and college. Several pieces of the text indicate the extent to which the federal government was trying to “patch over” the failure of the American Dream and convince policymakers that there was still a possible Dream to be had—if only the US would reaffirm its commitment to educational reform. For example, “What lies behind this emerging national sense of frustration can be described as both a dimming of personal expectations and a fear of losing a shared vision for America” (Gardner et al., 1983, pp. 11–12); however, the authors bolstered this claim with the neoliberal affirmation that, “All, regardless of race or class or economic status, are entitled to a fair chance and to the tools for developing their individual powers of mind and spirit to the utmost” (p. 8). Such anthems of idealism are rampant throughout the report.

The thrust of the text is clear and evolutionistic, and further, mirrors the claim by Straehler-Pohl and Pais (2014) who reached the same determination decades later in the European context: “Research is [as a result of the “mathematics for all” charge heralded by this report] moved by a desire for what ought-to-be in opposition to what is, thus failing to recognize the concrete conditions of today’s schooling” (p. 80). At the level of ideology, there is a paradox inherent in *A Nation at Risk*, namely, that the report claims that the issue is pedagogical in nature, whereas it is actually positing (and simultaneously disavowing) that it is political in nature. Qua political, the issue is thus ideological, because one of the primary purposes of ideology is to
serve as a defense mechanism against the Real (Žižek, 1999/2008d). The historical and political events of the First Epoch, being characterized as an irruption of the Real into the American system, led to the ideological claims *par excellence* in *A Nation at Risk* in the Second Epoch. From this ideological “backlash” against the First Epoch, the Second Epoch exemplifies an ideological investment *writ broad* in both evolutionism and neoliberalism. In other words, the Second Epoch was one that reacted against failure, namely, the failure of American mathematics achievement. As with all failure, ideology is necessary to “patch over” it, in order to neutralize its traumatic/Real effect (Straehler-Pohl & Pais, 2014); this “patching over” occurs through the mechanism of phantasy, and specifically, a *phantasy-screen* (Žižek, 2008d), where the screen metaphor indicates that it provides a filter between reality (viz. that students are failing) and the perception of reality (viz. that all students can succeed in mathematics if only the “correct” reform interventions are put in place, precisely as *A Nation* charged researchers). Both evolutionism and neoliberalism are ideologies based on the logic of the phallic function and are thus inherently masculine in the quilted-speeches they produce.

Thus, the Second Epoch can be seen as a time when the mathematics education research field began engaging *writ broad* in a masculine phantasy-screen as a defense against the Real irruption of the First Epoch. The corresponding injunction made by much of the research in the Second Epoch led to the American-centric thrust of both the empirico-psychological and the complexified sociological trends of the Second Epoch, with both being aimed at reifying the typical relations of American society, gender, and mathematics. The overall move away from the sex-typing arguments of the First Epoch avowed the neoliberal and evolutionistic goals of the American political project: girls can be just as successful as boys in mathematics, they can achieve, they can join the fight to reposition America at the top of the world order with respect to
mathematics achievement and scientific innovation. The Cold War was still in full effect during the Second Epoch—with the eventual collapse of the USSR occurring at the end of the Second Epoch—and America would again regain control of the world order. With such a specific political agenda characterizing the Second Epoch, the Third Epoch was set up to be an overall rejective reaction to the political aims of the Second Epoch.

2.3 The Third Epoch

The overall ideological character of the Third Epoch consisted of continued neoliberal influences, again with particular respect to the notion of achievement. A notable difference in this epoch was the beginning of critical influences, which began to shift the ideological commitments of researchers concomitant with the continued development and influences of postmodernism; this can be seen in the breadth of different cultural contexts that were being studied during this epoch. Finally, it should be noted that the engagement with critical theory during this epoch was somewhat pensive, because of the tenous relationship during this time period of critical theory and the academy; critical influences still needed to be “palatable.” Next, I elaborate these characteristics from their historical context.

One seismic shift in gender studies during the Third Epoch was R. W. Connell’s (1995) *Masculinities*, a text which directly called into the question the ways in which gender was being studied, and also called into question the role of scientific ways of knowing in studying the concept of gender. The position advanced by Connell explicated that scientific ways of knowing are themselves gendered, thus creating a circular character to any knowledge claims about gender. Connell develops this argument by juxtaposing science and common-sense:

>[During the last century,] just a whiff of scientificity was enough to establish a right to criticize common-sense knowledge; common sense did not criticize science.
Science has a definite hegemony in our education system and media. … But the appeal to science plunges us into circularity. For it has been shown, in convincing historical detail, that natural science itself has a gendered character. Western science and technology are culturally masculinized. This is not just a question of personnel[.] (Connell, 1995, p. 6)

With such a strong and unapologetic critique of scientific ways of knowing apropos of producing knowledge claims about gender, Connell’s work had a major impact on the ideological trends of the Third Epoch shifting so abruptly away from those of the previous two Epochs: the first two Epochs were largely influenced by scientism (and its “derivative” solutionism) as well as neoliberalism. While neoliberalism continued its influence during the Third Epoch, the influence of scientism was largely replaced by criticality, feminist influences, and postmodernism, which can be seen as being an effect of Connell’s influence.

Despite the Third Epoch being characterized in part by the extra-American expansion of research on gender and mathematics to other cultural and national contexts across the world, one of the most important delineators of the Third Epoch was the 1994 U.S. Department of Education (USDOE) report *The Condition of Education* (Smith et al., 1994). Two years earlier, in 1992, the American Association of University Women (AAUW) also published their infamous report, *How Schools Shortchange Girls* (American Association of University Women, 1992). Both of these publications had major impacts on the field of educational research, and I take these two reports together as demarcating the beginning of the Third Epoch. The ideological commitments of the AAUW and USDOE reports are clear when reading the first sections of each. The AAUW report states as its motivation:

> The educational system is not meeting girls’ needs. Girls and boys enter school roughly equal in measured ability. Twelve years later, girls have fallen behind their male
classmates in key areas such as higher-level mathematics and measures of self-esteem.

Yet gender equity is still not a part of the national debate on educational reform. (p. 1)

There is a notable ideological undertone to this statement, namely that the school system is in itself evolutionistic, but that something else is happening as girls age into their high school years that disadvantages them apropos of mathematics and self-esteem. I read the former as affirming the “desire for the phallus” nature of the masculine-quilted-speech, and I read the latter as avowing an ideological commitment to psychological arguments that, themselves, rely on scientism and interpellationism in order to be considered valid ways of knowing.

The USDOE report states as its motivation:

As a nation, we put great value on mathematics and science… this is evident in [our] National Education Goals: “U.S. students will be first in the world in science and mathematics achievement.” Nearly forty years ago, it was evident in our response to [the successful Soviet launch of] Sputnik. (p. v)

This claim is followed by an admission that recent achievement measures have not been keeping up with this goal. The report goes on to note that racial minorities have been increasing in achievement measures, despite the fact that, as the report notes, the gap between them and White students’ achievement is still “very large” (p. vi). The vast report of nearly 500 pages offers statistical reports on nearly every aspect of schooling that one could imagine.

Taken together, these two influential documents paint a picture for the 1990s and educational research: that the content is considered agnostic, that there is an evolutionistic conception of the school system, and thus, the lack of achievement parity by high school should be “fixed.” Further, the motivation of this “fix” is inherently political, in order for U.S. students to be able to contribute to mathematics and science on the world stage. Enabling girls to achieve
at the same level as the boys is thus installed as an ideological thrust of the 1990s. Note that, in this rhetoric, the purpose is not to question the nature of mathematics, nor that perhaps the boys are overachieving. Further, there is no question about the benevolent evolutionism of the capitalist mode of school itself. In particular, the fascination of the moment with international comparisons aligns highly with the literature found in this Epoch. In addition, the AAUW report, which itself took a rather “neoliberal feminist” approach indicates the first Epoch to experience an influx of—what was then—the burgeoning feminist studies field. As will be noted later in Chapter IV, one characteristic of the North American feminist theory field of the 1990s was a notable absence of critical political economy (Marxian and related theories) and transnationalism topics in coursework and venues of academic discussion. Evidence of these ideological thrusts are evident throughout the literature of the Third Epoch.

2.4 The Fourth Epoch

The overall ideological character of the Fourth Epoch consisted of heavier influences from postmodernism, particularly with respect to contemporary ways of thinking about gender and further studies done in different cultural contexts. This postmodern influence can also be seen in the avowal of the nonhomogeneity of gender research in mathematics education during this epoch. Modern technological advances contributed to a resurgence of solutionism and evolutionism. Neoliberalism also continued to be a driving factor, especially after the events of 9/11. Next, I elaborate these characteristics from their historical context.

The Fourth Epoch notably coincides with two significant American events around the year turn of the century: namely, the passage of the *No Child Left Behind* (NCLB) Act, and the 9/11 terrorist attacks in New York. In a series of events that in many ways mirrors the events that shaped the transition between the First and Second Epochs, the Fourth Epoch can be seen as
characterized by a resurgence of American Militaristic Exceptionalism and its associated neoliberal and evolutionistic influences. These two events achieved two aims: first, the role of the federal government was amplified, and second, the goals of American education were incrementally lowered and privatized. This increasing politicization of the American public school coincided with increased jingoistic nationalism in response to the terror attacks. The goals of education became more “corporate” rather than academic, as the message espoused by the NCLB was designed to put heavier focus on standardized testing at the expense of the insights provided from nearly a century of dedicated educational theory and philosophy work. The distinctive shift, during this epoch, to a heavier focus on “corporate standardization” of the learning outcomes of American public schools was met, perhaps unsurprisingly, by a notable bifurcation in the educational research field: on the one hand, many scholars took increasingly critical stances in their work, such as research on gender, and this effect is evident in the overall characterization of this Epoch. On the other hand, some scholars acceded to the increasingly corporate demands of the political situation, and further worked to advance this new vision for education, one that devoted itself to ideologies of evolutionism and—increasingly in the new century—solutionism. It was at this time, with the advent of personal computing and after the “Dot Com” boom of the 1990s, that technology started becoming an integral part of the educational experience. Mathematics, a crucial building block for enabling technology education and use, was ideologically upheld through a solutionistic “revival” of sorts: now, with widespread technology, we had a new reason to believe that mathematics would necessarily lead to a better world. This commitment of the epoch to solutionism can also be seen in the reform efforts that began in the 1990s and reached fruition in the 2000s: the National Science Foundation’s funded development of reform curricula was answered with many mathematicians
speaking out against such reform efforts. The resulting effect of this was the pitting against each other of various curricula, which ideologically suggests that there was a “correct” way to be researching the teaching of mathematics—a “correct” way that could, if realized “correctly,” lead to more successful solutions to the educational problems facing America’s schools and universities.

2.5 The Fifth Epoch

The overall ideological character of the Fifth Epoch consisted of a shift back towards scientism with the uptake of neuroscience research. Neoliberalism shifted towards a more complex way of thinking about achievement, but continuing to avow the virtue of achievement nonetheless; an example can be seen in claims of men overachieving. Postmodernism continued to increase its influence through increasingly local ways of theorizing equity. Next, I elaborate these characteristics from their historical context.

The Fifth Epoch potentially indicates why the present study is urgent now, after the primarily scientific speech of the previous epochs. Since 2010, gender has received unparalleled attention. My claim here is that it is not coincidental that the advent of the transgender era was concomitant with the rise of right-wing nationalism worldwide, the continuing onslaught on education through standardized testing, and privatization/defunding. All of these characterize the Fifth Epoch, which, perhaps uncoincidentally, also recently ushered forth the political discourse on the critique of science. Nowadays, science is no longer science, it is a political stance. For these reasons, I claimed in Chapter I that psychoanalysis is needed now, to identify and analyze the symptoms that have been created by the scientific thrust of the previous Epochs. Apropos of gender and education, the Fifth Epoch saw a veritable “roller coaster” of changes: violence in schools saw an all time high; in 2016, President Barack Obama issued transgender bathroom
protections for school students; in 2017, shortly after assuming office, President Donald Trump rescinded those protections. Overall, school was no longer an academic arena by any measure, but was only seen as a political arena. Notwithstanding this, two trends on gender research can be seen during this Epoch: on the one hand, critical methods became a major influence, which is evidenced by the fact that some of the artifacts found during the literature search for the present study to mention ideology at all were published during this Epoch. On the other hand, the increasing “mathematical formatting” of the technological advent of the Fifth Epoch continued to push for a solutionistic view of the world and the role of school students in it. In both of these trends, we see the uptake of educational research as a distinctly political maneuver, and the role of gender in the lives of school students became a veritable political battleground. My overall reading of this Epoch is quite concise: symptoms… everywhere. The constant espousal by the right-wing of the state political apparatus of the dangers of “gender ideology” indicate the extent to which ideology continues to be misused in the name of American Exceptionalism: there is in fact no “gender ideology,” but the trends of the Fifth Epoch show the extent to which it is sex that has been ideologized. For this reason, the role of the phallus in installing and reproducing the masculine-quilted-speech sets up the political context for the present study. It is quite simply the $S \rightarrow a$ (the attachment of the psyche to the desire object, which is the transcendental condition of embodiment for masculine phantasy; see Lacan, 1967/n.d.-b, 1975/1998) that has led to all of the symptomatic disavowals of the ideologization of sex that characterize the crucial mis-interpellations of gender that continue to concern researchers. In the midst of this situation, the present study offers a counter-perspective.
3 Benbow & Stanley (1980) (First Epoch)

Benbow and Stanley (1980) suggested that males were more innately capable of mathematics than females. In their study, they performed talent searches to find suitable participants with equivalent (and high-achieving) mathematical backgrounds. Consider these particularly ideologically loaded statements in the study:

“Six separate SMPY [Study of Mathematically Precocious Youth] talent searches were conducted” (Benbow & Stanley, 1980, p. 1262), where students were recruited into the study based on high mathematics achievement and no other factors. This statement reflects an ideological commitment to neoliberalism because it disavows the role of economy by assuming that the SMPY would capture students in an unbiased way. However, the disavowal of economy in this process commits the study to only the logic of capitalist accumulation. They continue by saying, “[I]n all [talent] searches, the girls were equal verbally to the boys” (Benbow & Stanley, 1980, p. 1263). This means that the study was conducted purely within the referent of masculine jouissance, because the signification standard-bearer was that of the boys. In other words, the masculine signification that was deemed as the only valid referent implicates masculine jouissance, and thus the study is conducted as an exercise in masculine-quilted-speech.

In yet another example, “[The sampling methods used suggest] that the same results in the high range [of mathematics achievement] would be observed even if a broader population [i.e., not only sampling from mathematically high-achieving youth] were tested” (Benbow & Stanley, 1980, p. 1264). This reflects a commitment to scientism and solutionism, because the statement reflects quantitatively that the capitalist mode of school is functioning at the level of master-signifier—that of the concrete universal of economy—and that, further, the methods used are invested in a greater yet neutral good that is simultaneously agnostic towards the gender of
the students and that the application of these quantitative methods will lead to a better world. Because scientism and solutionism are all based on teleological signification, the authors commit themselves to masculine jouissance in the study.

Taking these three excerpts together, the following picture can be inferred: The article seems to say that boys are naturally more mathematically able than girls, and that this observation would hold for the general population despite the study only being conducted on high-achieving, self-selected students. However, the purpose of the article seems to be double: by maintaining the significatory position of the boys as the referent (“the girls were equal verbally to the boys”), the study affirms that the masculine-quilted-speech is indeed the only valid speech of mathematics. Then, yes, boys are probably more mathematically able than girls, when the masculine-quilted-speech is the referent. The study thus seems to suggest that girls need more support in order to be able to achieve in the masculine way (viz. gain access to speaking the masculine-quilted-speech). Thus, the study is not so much a call for men’s superiority in mathematics (its consciously espoused purpose) as it is a call for studying only the symptoms of the masculine-quilted-speech in mathematics, which is affirmed by this closing remark:

We favor the hypothesis that sex differences in achievement in and attitude towards mathematics result from superior male mathematical ability, which may in turn be related to greater male ability in spatial tasks. … [Our results likely suggest] that putting one’s faith in boy-versus-girl socialization processes as the only permissible explanation of the sex difference in mathematics is premature. (Benbow & Stanley, 1980, p. 1264)
The purpose of making such a strong claim is one of affirming the inherently masculine logic of the capitalist mode of school mathematics (success/failure; school credit system) insofar as it invalidates all other (viz. potentially feminine) logics. So, yes, the study seems to make a reasonable claim: boys are better at doing mathematics in the masculine way than are girls. What does this prove? It suggests that the only valid equity work on gender in mathematics education should not be about gender diversity, but rather about gender homogenization—with girls’ mathematical speech being homogenized to the masculine position. By committing themselves to the ideologies of scientism, evolutionism, and solutionism, the study suggests that the authors’ purpose in publishing the study was to say: Let us keep the masculinity of mathematics as the standard, and protects its exclusionary virality and teleological signification.

4  Fennema & Sherman (1978) (First Epoch)

While the Fennema and Sherman studies (Fennema, 1974; Fennema & Sherman, 1976, 1977, 1978; Sherman & Fennema, 1977) were crucial in challenging the male superiority argument in the 1970s, they nonetheless committed ideological intrusions against the women they were seeking to help. My purpose here is not to denigrate the importance of their work, but to reveal how ideology and the unconscious are functioning despite researchers’ best intentions to absolve themselves of their effects. Consider these excerpts from Fennema and Sherman (1978):

“This sample represents the entire population of Madison, Wisconsin, and although predominantly middle class, includes great diversity in socioeconomic status” (Fennema & Sherman, 1978, p. 191). Notwithstanding this admission, economic class was not engaged in the article, which constitutes an ideological commitment to neoliberalism, because the study (the primary focus of which was on gender) ideologically retains the middle-class position as the only
valid referent. Thus, the effects of economy on gender are flattened for the very poor and the very rich. However, since gender is a consequence of ideology (Morel, 2023), the concrete universal of political economy must be considered a precursor to the “visible manifestation” of gender: by disavowing the role of economy, these researchers adopt the ideological position that the “gender of the middle class” is the least adulterated social manifestation of gender, and thus must promote the least biased impact of gender on mathematics education.

They continue: “[M]ales were more confident of themselves in regard to mathematics and stereotyped mathematics as a male subject to a greater degree than did females” (Fennema & Sherman, 1978, p. 200). The “males” in question were school-aged students who had presumably only experienced the capitalist mode of school mathematics, which as I have previously explained is primarily characterized by its masculine jouissance. Thus, it is rather quite tenable that males stereotyped mathematics as masculine more than did females, because males are socialized to prioritize masculine jouissance over feminine jouissance (viz. prioritizing the masculine desire to signify), making their only experience of mathematics “gendered” in precisely the same way as they themselves had been. This becomes even more clear when considering the Formulas of Sexuation (Lacan, 1975/1998): the feminine side is where the Big Other as barred is situated. However, if mathematics takes on a psychotic structure (Moore, 2022), then it is precisely in the failure of the Symbolic (i.e., the Big Other) that the psychosis originates: the feminine position would be to “see” the psychosis for what it is, and orient herself as such—that of the $S(\mathcal{A})$ position. Who is it that interrogates this subject-position of active

---

65 I make this claim as my own interpretation of the ideological effect of the artifact. To be clear, this is not necessarily what the authors were intentionally doing with the work. As with all ideology though, the danger of it lies in believing that one can believe that they do not know an ideology is structuring their actions (Žižek, 1989/2008a). The same could be applied to me in performing the present analyses. The authors, in writing the artifact in this way, were providing transparency about their data collection and methods. However, with any speaking/signifying act, enjoyment is present and thus ideology is present—typically unbeknownst to the speaker. This means that simply describing a study in the typical academic way is an ideological act.
subjection to the Big Other? It is woman, the true feminine position. Thus, the study’s claims about the greater prevalence of male stereotyping of mathematics as masculine is rather unremarkable: the Formulas of Sexuation are merely working as Lacan theorized. However, if it is woman that is doing the interrogation of the men’s stereotyping, then it must not be from within the feminine-quilted-speech: woman has no place in the feminine quilted speech, rather, only woman does.

Notwithstanding this, the study continues to suggest that it is due to socialization that women are disadvantaged in mathematics:

[T]he lack of replication of results by school area is interesting…. The spotty nature of the findings of superior mathematics achievement by males, which was always found in conjunction with a host of less favorable attitudes by females, suggests that important negative influences may exist within the schools themselves. (Fennema & Sherman, 1978, pp. 201–202)

This suggests that the authors have committed themselves to the ideologies of neoliberalism and postmodernism. In terms of neoliberalism, they retain the position that women can succeed at the same level as men, which can be read as suggesting the implication that women need to be given the supports and opportunities to do so. In terms of postmodernism, the authors are disavowing (as previously stated) the role of economy as the only concrete universal (Žižek, 2018) and assuming that differences related to gender itself are delineated locally amongst schools: the Marxist reading of this ideological commitment is that the study has flattened economy to the middle-class referent, thus eliminating any impact of economy on the study’s stated results. For example, “One major finding of the high school study was that sex-related differences varied by high school area” (Fennema & Sherman, 1978, p. 200)—this ideologically indicates that capital
is the only concrete universal, because the disavowal of the study to conceive of capital as such results in the authors’ beliefs that gender develops “differently” independently of economic class. The authors could have linked this finding to the concrete universal status of economy, but by choosing not to, they demonstrate an ideological commitment to postmodernism and thus—crucially—to the belief that gender develops on a personal basis. However, for Lacan, this would make no sense, because there is no a priori human being, there is only the social link: thus, we develop and express our gender because of how society tells us to, and since that society differs along economic class lines, those expressions of gender are in fact consequences of political economy.  

Furthermore, the study seems to make an ideological commitment to evolutionism and scientism as one of its defining goals, although, of course, they are never stated as such. The study can be generally characterized as evolutionistic because it assumes that it is being guided by a “sovereign Good” goal of more gender equity for women. While this may be true, I wager that because the study retains the masculine-quilted-speech as the only valid speech for which women can participate in mathematics (if only they are given enough of an opportunity and support to do so), that the study is not a call for more gender equity, but rather is a call for more gender homogenization with the masculine position as its referent. In terms of scientism, my critique here is similar to that of the Benbow and Stanley (1980) study, which is that quantitative  

---

66 It is perhaps impossible to separate “intended ideological stances” from “communicated ideological effects,” because, according to Lacanian theory, it is language that uses us, not the other way around. I make no claims as to what the authors of the artifacts analyzed intended ideologically; I can only read what they wrote and make my own claims about it. For me, as is for the authors of the analyzed artifacts in the present study, we are always-already in ideology. Thus, I do not “conflate” intended versus communicated ideologies; there would be no way for me to do so. In my view, the belief that they can be separated indicates an erroneous conception of what ideology is. Specifically, here, I refer to the psychical mechanism called sublimation (Lacan, 1986/1992). An example of this typical (mis)use of the concept of ideology can be found anywhere that ideology is conceived of as always-already being negative or bad. Ideology is simply what we are saying, because what we are saying, we are enjoying. Thus, my use of the concept “ideology” in the present study should be conceived of only in the Marxist-Lacanian way.
methods are valued for their supposed objectivity, their unbiasedness, and that by employing scientific methods, the “true goals of equity” are not obscured behind the subjective nature of qualitative research. However, from the position of an ideological critic, this represents a commitment to scientism, which, as I have previously explained, is primarily characterized by its masculine jouissance. Thus, within the evolutionistic and scientistic commitments, the study seems to be suggesting that the masculine-quilted-speech is not the problem, but that women are too-quickly discounted in terms of their ability to accede into the masculine-quilted-speech and that they should be given more support to do so, which further reinvests the masculine jouissance of the study’s approach.

Taken together, the following picture can be inferred: The purpose of the study is to critique and juxtapose the prevailing arguments of its time, namely, that men are naturally superior to women in mathematics, such as the argument taken up by Benbow and Stanley (1980) in the previous example. For this reason, the article takes on a noble and important task. However, the ideological commitments of the study to neoliberalism demonstrate that the authors are retaining the masculine-quilted-speech position as the valid referent for women’s success in mathematics. Further, in terms of the study’s ideological commitments to postmodernism, the study does not seem to suggest that gender is a consequence of ideology (and thus of political economy), thus eliminating all of the potential texture of its data from revealing how economic class creates and reifies gender in a particular way that is different from the middle-class expression of gender.

5 Becker (1981) (First Epoch)

This article represents a high degree of ideological commitment to interpellationism and neoliberalism. First, consider this excerpt: “To capture these [subtle aspects of behavior in the
mathematics classroom], this study used techniques of participant observation, a qualitative methodology that starts with tentative questions and develops working hypotheses as data are collected in the field” (p. 41); this is the most ideological position one could take, and exemplifies interpellationism. The author’s language, although they do not say it, points to the masculine-quilted-speech and indicates that the teachers in the study were qualifying the students’ labor-power against it, which shows the sublimation of capitalist logic inherent in the researcher’s speech, such as in this quote: “Teachers seemed more willing to persist with male students. … Although males and females asked for help in almost equal numbers, teachers were more likely to approach male students to check their work and to determine if they needed help. Also, teachers tended to spend more time with the males” (p. 48).

The author additionally seems to affirm the role of the Formulas of Sexuation, but is not able to pursue the consequences, due to the ideological influences in the article. For example, “Most interesting is that sex differences in teacher and student behavior were less marked [in the 9th grade classes] than in the 10th grade classes” (p. 48); this indicates that as students get older and more “invested” into the social order, the Formulas of Sexuation are having a greater effect in the quilting of their speech, with greater burden placed on the girls to “rise to the occasion” of the masculine-quilted-speech of mathematics.

Consider how the ideological presumption of an a priori human-being, explicitly excluded from psychoanalytic thought, impacts the analysis afforded by the article’s paradigm: “The female students as a group tended to be quieter and more passive in class than the males. However, there were indications that such behavior might have been caused just as much by the situation as by predisposition” (p. 48). This is an example of how ideological presuppositions of human-being, by suggesting that the girls’ predispositions were somehow a disadvantaging factor
in the context of the mathematics classroom. The authors uphold the “privileged position” of the masculine side of the Formulas of Sexuation—and thus, uphold the privilege of the masculine-quilted-speech—through claims such as this that disavow the feminine side of the psyche:

“Another class was fairly balanced in sex distribution but had the teacher who showed the greatest tendency to interact with males more frequently. … [The female students in this class] seemed to have closed up into a shell; they did little talking before, during, and after class. One could easily have forgotten that they were in the class if one just listened to those who spoke” (p. 48).

Overall, this artifact seems to suggest that the masculine “version” of mathematical signification is the implicit standard, and thus the artifact does not seem to be concerned with “equity for the girls” other than seeking to promote equitable access to the masculine-quilted-speech.

6  Jacobs & Eccles (1985) (First Epoch)

This article focused on the Mother/Father dynamics and the impacts of media reports on “gender and math” on their child’s math ability and future achievement, in light of the media reports on Benbow and Stanley’s (1980) work. However, the article maintains an ideological devotion to the masculine-quilted-speech through the employment of psychological theories, thus indicating an ideological commitment to interpellationism (and thus scientism), in addition to neoliberalism and solutionism. Apropos of neoliberalism, this artifact focuses primarily on the dimension of aptitude, which is, in effect, utilized as a transcendental proxy for achievement. The interpellationist commitment of the artifact can be evidenced in the following excerpt:

[T]he centrality of parents' beliefs regarding the relationship of sex to math aptitude should influence the extent to which they incorporated the media's message into their
belief system. Both one's own sex and the sex of one's child should affect the centrality of one's belief system in this domain. (p. 21)

The authors indicate that there should be a certain level of “transparency” or “intelligibility”—or what I would call interpellatability—regarding the parents’ “readings” of their own gender and that of their child. Then, in the very next sentence, the ideological commitment to interpellationism is made clear, when the authors switch from signifying “sex” to signifying “gender” with no clear explication that they are intending for these terms to be conceptualized differently:

Because mothers and fathers have gender-stereotyped beliefs regarding both their own math aptitudes and their children's… gender-stereotyped media information should reinforce these beliefs and encourage them to generalize their self-perceptions to their same-sex child. Consequently mothers of daughters and fathers of sons would be expected to incorporate the media's gender-stereotyped message into their beliefs to a greater extent than other parents. (p. 21)

This is a prime example of the “ideologization of sex,” in that the author’s conflation of the signifiers “sex” and “gender,” seemingly to represent the same thing, indicates that one must “read” their own gender as a sex-derived position, thus recruiting both theirself (e.g., the parent) and the object of their gaze (e.g., the child) into the belief that gender is sex, and that gender positions are intelligible identities.

Finally, the solutionistic thrust of the artifact can be seen in the way that quantitative methods were used in order to claw back some of the detriment caused by Benbow and Stanley (1980), which was the motivation for the article; if the mathematics of the quantitative methods employed in the study were only done with the proper application, the negative aspects of
Benbow and Stanley’s work could be at least partially undone, thus leading to a better outcome for society.

The ideological indications in the article’s language, since this article was distinctly “feminist” in relation to other work of the Epoch, indicate that the authors may have adopted the position that society was “post-Oedipus,” an ideological commitment that would have enabled a “feminist” approach that also allowed for the avowal of the masculine-quilted-speech. By maintaining a psychological orientation, the article disavows the role of the Oedipus complex and the Che Vuoi, and moreover, as with most psychological artifacts, this posits an autonomous Subject who, in fact, does know what they want—and, if supported correctly, will achieve it.

7 Carr et al. (1999) (First Epoch)

This artifact represents an exemplar in what I call the “ideologization of sex,” which in the case of this artifact was likely done in order to enable ideological commitments to interpellationism, scientism, neoliberalism, and solutionism. For example, the authors use the signifier “gender,” but then categorize “boys” and “girls,” which serve as signifiers of sex. By conflating gender and sex, the ideological commitments of the authors indicate that they are enjoying the masculine-quilted-speech, such as in this excerpt:

We believe that teachers may have been trying to teach those girls who were not spontaneously using retrieval to use retrieval via direct instruction on this strategy and to use metacognitive information about strategies via direct instruction that provided metacognitive information about strategy use. Teachers might have been reinforcing the use of retrieval strategies in boys, however, only if boys were already capable of using them. (Carr et al., 1999, p. 33)
This excerpt indicates a commitment to neoliberalism (by avowing the potentiality of each student if only the correct instruction method was used), and also that the authors are enjoying maintaining the privileged position of the masculine-quilted-speech by implicitly holding the boys’ treatment as the norm and conceiving of the girls’ treatment as deficient.

Evidence of a solutionist commitment par excellence can be found in this excerpt: “When the effect of parents’ instruction on both strategies and metacognitive information about strategy use on correct use of retrieval … was examined, only gender was a significant predictor. Boys were more likely to correctly use retrieval than girls” (p. 35). How can gender be a predictor of anything? It’s “sex” that’s the predictor here. Gender, when quantified, becomes an exercise in the masculine-quilted-speech overdetermining gender in order to produce the category of “woman.”

Or, consider the effects of interpellationism, through this quote: “However, the significant interaction indicated that this relationship is qualified in that the relationship between teachers’ instruction on retrieval and the correct use of retrieval was positive for boys and negative for girls” (p. 36). The interpellationistic design of this study shows that the researchers enjoy signifying the girls in the study through the (masculine) accumulation logic of the masculine-quilted-speech, because it is only through quantifying “what the girls were doing or not doing” can their success in mathematics be read: and, when read, it is being read with the “cipher of meaning” provided by the masculine-quilted-speech.

Another example of the disavowal of the role of failure (of the girls) comes through here: Girls, in contrast, did not appear to benefit as much as boys and, in fact, were hurt in their strategy use by their interactions with their teachers. [A possible explanation for this is]
that teachers spend more time working with boys on their mathematics and that boys’
strategy use may have improved as a result of this instruction. (p. 36)
The girls are being “hurt” in terms of their attempts to access the masculine-quilted-speech (vis-
à-vis their increased frequency of interactions with teachers). The scientism and interpellationism
inherent in this study design sees no place for studying the failure of these pedagogical
interactions for the girls.

The implicit referent position of the masculine-quilted-speech in the social order is,
further, evidenced here: “[At both the beginning and end of the semester], boys were more likely
that girls to say that their parents preferred strategies that make one look smart” (p. 37). Because
the masculine-quilted-speech of mathematics is what codes mathematics in the Symbolic as
masculine credibility. Thus, “looking smarter” in mathematics means “looking more like a man.”
Thus, because of the role of the phallus in installing speech, the masculine-quilted-speech is here
upheld as “desirable”—literally, the “desire for the phallus.”

The authors conclude:
These data replicated [a previous study by the first author] with boys correctly using
retrieval during the first grade more than girls and girls correctly using overt strategies,
such as counting on fingers and counters, more than boys… Researchers should further
examine exactly how adults influence boys’ strategy use and why parents and teachers do
not influence girls’ strategy use in the same way. (p. 42)
What does this study do? It posits the girls’ strategies as less desirable and less developed
( perhaps, more “simple”), and then pathologizes this same finding. The study seems to be
interested in fixing the meaning of the differences between the boys and the girls, rather than
liberating the girls from what the study admittedly identifies as the high potential for the
instruction (provided by the teachers and the parents) itself to be gendered. If this study replicates some of these findings that the primary author had already found in a previous study, why publish this, except to continue “enjoying” the gap between the girls and the boys, and to conceive as deficit and pathologize the girls’ attempts to be successful at accessing the masculine-quilted-speech (i.e., success in mathematics class). Recall that the material, when grasped as ideal, produces ideology. So, for these researchers, the girls are materially a symptom of the boys (as is the true psychical situation), yet this symptom is idealistically grasped, so that there remains—ideologically—the possibility that they can be “cured” of their symptomatic mathematical deficiency, and pedagogically given the chance to accede to the masculine position. Because of the imposition of the masculine-quilted-speech on the production of this artifact, the girls’ behavior in mathematics class indicates that they have “given up some of their desire” (which constitutes a symptom qua “compromise-function”; Žižek, 1994/2005, p. 142) in order to be “quilted” into the masculine-quilted-speech as a symptom of the boys. In this way, this study perfectly illustrates the effect of ideology on thwarting researchers’ attempts to scientifically “read”/interpret/recruit the girls: they are simultaneously not fully admitted into the Symbolic and yet are entirely subject to the Phallic function.

8 **Lamb (1996) (First Epoch)**

This artifact focuses not on girls as a whole group, but “which groups of girls and in which school settings” are more disadvantaged. This indicates that woman is not-All. However, the study seems to maintain that achievement in mathematics is an ideal in the modern, capitalist market:

The underrepresentation of females in mathematics is an important issue not least because mathematics in senior school acts as a critical filter in selection for higher
education... . This is partly reflected in access to areas of study. Many more females than males might now enter university but they remain underrepresented in a range of technical, scientific and engineering fields for which mathematics and the physical sciences are basic prerequisites[.] (p. 224)

Notwithstanding this, social class is pathologized by the study:

Analysis of socio-economic patterns shows that social class cuts across gender differences in such a way that despite the lower chances of girls as a group, many middle-class girls continue to access the most profitable stream of mathematics study thanks to their family background. (p. 225)

Here, the masculine-quilted-speech serves as a middle-class phantasy: an aspirational hope that by virtue of being middle-class, these middle-class “girls” may quilt into the masculine-quilted-speech of mathematics and thus become profitable producers of (the “correct”/masculine) qualified-labor-power.

This ideological commitment becomes clear again, with the article’s conclusion that “gender was overriding the effects of social class” (p. 236, emphasis in original). Does this not indicate how gender is functioning as an agent of (masculine) accumulation in the capitalist mode of school? By stating that “gender was overriding the effects of social class,” the researchers seem to be enjoying the ability of gender to “save” the lower-class students from the undesirable fate of not being successful in mathematics qua inserting themselves into the market.

Lastly, consider the following excerpt:

It would appear [in the data] that social class selection cuts across gender differences in such a way that despite the lower chances of girls as a group, some girls continue to
access the most profitable stream of mathematics study thanks to their family background. In short, social class compensates for gender. (p. 237)

Ideologically, this statement by the researchers contains a paradox. On the one hand, they are saying that “some girls” (those from the higher social classes) are able to masculinize themselves enough that they can succeed at the same level as the boys, which the researchers homologize to “accessing the most profitable stream of mathematics.” On the other hand, they claim that girls are not a homogenous group, indicating support for Lacan’s claim that woman is not-All (not homogenous). This paradoxical claim affirms the homogeneity of the girls, while committing the neoliberal forgery that, despite their gender, girls who are more socioeconomically advantaged can still “overcome” this gender disadvantage and accede to the masculine, capitalist, and accumulable logic that in itself defines the masculine-quilted-speech. Thus, the study commits itself to ideological positions that maintain and advance the hidden referent position of the “masculine and capitalist” as the standard.

Furthermore, the researchers state that they are studying gender; they are not, they are studying sex. This continued conflation of gender and sex is one of the reasons that, today, we have the proliferation in popular discourse of the notion of “gender ideology.” By grasping the students’ material sexed bodies as the idea of gender, this study advances the misrecognition in the field’s quilted speech that sex represents gender. At the level of ideology, this misrecognition is only possible through the (masculine) logic of the masculine-quilted-speech. To push this thinking one step further, note that it is the masculine-quilted-speech that also allows the researchers to arrive at the same paradoxical statement I critiqued above.
This article reports on an unexpected “reverse” effect on equitable outcomes when an intervention was applied in the classroom:

A recent educational project in Liberia provided an opportunity to test the claim that programmed teaching and programmed instructional materials could improve student achievement over more conventional instructional approaches and at the same time minimize gender-related achievement differences. (p. 100)

The authors are “enjoying” the idea that they can improve outcomes, which is evolutionistic. For example: “It was hypothesized that the existence of any gender-related achievement differences would be minimized in the TEL program because the use of the IEL materials would serve to ensure that boys and girls received the same instructional treatment” (p. 101). This highly structured instructional treatment is very phallic, because it is based on masculine enjoyment of the signifier. In other words, “boys and girls receiving the same treatment” means that the girls were being expected to become men.\(^67\) The authors indicate the quantitative difference in the correctly answered differences on an assessment instrument. The issue is not with the girls (as posited by the study), but with the ideologies that formed and guided the study. They are inherently masculine ideologies.

Consider these closing statements in the article:

Though not consistent across all comparisons, significant treatment-by-gender interactions were detected in three of the six. While mean effects were not large, significant interactions were observed in grades 3 and 5 mathematics and grade 5 English. In all three cases, boys in the IEL program outperformed girls in the IEL

\(^{67}\) This result is akin to the findings of Johnson and colleagues (2020), which motivated the present study.
program to a significantly greater degree than was observed in the other two programs.

… In short, the IEL program seems to have enhanced student achievement while at the same time increased the gender gap in achievement between boys and girls. (p. 104)

These claims indicate the extent to which the girls could “masculinize” themselves qua accede to the increased masculine-quilted-speech character of the interventional program; perhaps unsurprisingly, this study overall mirrors the ideological character of the Epoch.

10 Yee & Eccles (1988) (Second Epoch)

The article begins by avowing what I would call the role of “cruel optimism” for girls in mathematics (see Berlant, 2011), by basing its motivation on the fact that:

From junior high school on, girls express more negative attitudes toward math and rate their math ability lower than do boys even though objective indices suggest they are performing at comparable levels; furthermore, girls rate math as less important and less interesting than do boys … This paper focuses on one possible role that parents may play.

(p. 318)

This study falls short of being able to offer any emancipatory potential for the girls; this is because the logic of the capitalist mode of school is not questioned in the study. Rather, it remains committed to the neoliberal ideology, that girls still have the potential to achieve, which matches with part of the ideological character of the Epoch.

The impacts of the ideological commitments of the authors is glimpsed through their pursuit of understanding “causal expectations for successes and failure” (p. 318). These have already been predetermined by the Oedipal complex, so, as with most psychological theories, they are providing retroactive justification for the logic they employ.
The article also commits the interpellationistic “ideologization of sex” to represent gender, as can be seen in this excerpt: “Establishing the relations between child's gender and ability level and parents' causal attributions is the first step in evaluating the attributional model outlined above” (p. 320). Use of the signifier gender does not guarantee that one is, indeed, talking about gender. However, ideologizing sex in order to speak about gender, as is the affordance of interpellationism, indicates the role of the masculine-quilted-speech in the authors’ position, such as the relationship they posit between effort and achievement: “To assess this relationship, we will correlate parents' causal attributions for their child's math success and failures with their ratings of their child's ability in mathematics and their child's effort in mathematics” (p. 320).

It is notable that, although they tried, most fathers of the “low ability” children were not interested in participating in the study: “For children of high and average math ability levels, both mothers and fathers participated. For children of low math ability levels, only mothers participated as several fathers could not be reached or refused to participate” (p. 321). It is likely that the fathers were not interested in participating if their children are not signifying, because it implicates a phallic failure on their part. The “idea of the couple” (Lacan, 1967/n.d.-b) as installed by the phallus is shown to be a phantasy, not a reality, because they have failed to install the phallus in an unbroken line through their progeny.

Next, consider this excerpt: “[Parents were asked] how their child's talent and effort in math compared to his/her talent and effort in other subject areas, and how their minimum and maximum grade standards in math compared to such standards in other subject areas” (p. 322). I doubt this actually reflects a theoretically informed notion of “effort” other than the neoliberal
version that underpins the capitalist mode of school—especially during this Epoch—which is the effort needed to be successful specifically in the form of getting good grades.

Finally, consider the first claim within the results of the study:

Thus our prediction that parents would hold lower math achievement standards for their daughters than for their sons is partially confirmed. It is true for fathers only and only for students with average math ability … So consistent with our findings of lower minimum standards for average ability girls, fathers responded differently to sons' and daughters' of average ability. (pp. 323–324)

This seems to confirm the role of the phallic function in the “gender process” of becoming-gender-embodied, because the phallus is the signifier that installs Lack, thus indicating that the authors’ finding that fathers of average-ability children saw their child as concomitantly struggling with their mathematics and their gender—that, in both cases, their child “hasn’t figured it out yet.” From the perspective of the MQS, this concomitancy is to be expected because it is characteristic of the MQS via its phallically-installed transcendental condition of masculine phantasy/knowledge. However, within the ideology of the study, this is seen as treating the daughters in a deficit way; this supports the masculine-quilted-speech as the referent position for the capitalist mode of school.

Here again is another result: “Mothers of more able children gave higher ratings to their child's general school performance and current math performance” (p. 324). The feminine position as interrogating the phallic function. This could be because the feminine position affirms their embodiment as a collection of objet a's, and thus does not “attribute” these objet a’s to being determinative of their child’s development. In other words, the woman’s position affirms “true effort” outside of the “version of effort” that can be signified by an objet a. These mothers’
“ratings” of their children seems to affirm that the feminine position is one of knowing that one is the subject of an inconsistent social order whose rules are being imposed from without (S(A)).

A notable result apropos of the concept of effort is noted here: “[E]ffort and teacher help, both unstable attributions, were rated as the most important causes of success for both average- and low-ability students” (p. 325). I interpret this as saying that “effort” is an “unstable” attribution because, within the capitalist mode of school, effort doesn’t actually mean effort, it means the extent to which one was successful in producing the desired form of qualified-labor-power (see Baldino & Cabral, 2013, 2015, 2018).

The article does make a few claims about failure, which indicates what might be a “first” indication as to what a feminine-quilted-speech might entail. The authors discuss the relationship between failure, guilt, and hopelessness, which glimpses the radical difference inherent in the feminine-quilted-speech. However, ideologically, the feminine-quilted-speech ends up being adjusted back to the masculine-quilted-speech referent position within this study, and thus the ideological influences of this artifact make it likely that any emancipation potential for the girls in the study might be adjusted back to the (masculine) logic of the capitalist mode of school.

For example, “Parents were clearly sensitive to their child's math capabilities” (p. 327). I interpret this as the parents being sensitive to the role math plays in delineating their child’s entrance into the market. Moreover, “Mothers credited more able children with talent and less able children with effort” (p. 327); there’s an ideological difference here: The hidden referent for both of these signifiers, in this configuration, upholds the masculine-quilted-speech as the "desired” form of qualified-labor-power their child is producing. “More able children” becomes a coded form of “naturally more masculine, more phallic” whereas “less able children” means
they have to put forth more “effort” to accede to the demands of the phallus inherent in the masculine-quilted-speech.

An example of the masculine-quilted-speech at work can be found here: “Yet parents rated talent as the most important reason for the child with high math ability while effort was the most important reason for the child with average math ability” (p. 327). Here, “talent” becomes a metaphor for “seeing the phallus.” Further, “although parents tended to endorse lack of talent as a more important explanation for math failures of less able children, lack of talent was the least preferred of all the failure attributions” (p. 327); “Lack of effort” as the reason for failure is ideologically coded here to mean “lack of masochism” apropos of the phallus in the masculine-quilted-speech. The parents do not seem to be comfortable with admitting that their child may be taking the feminine position in mathematics, and, instead, interrogating the phallus rather than acceding to its demands in the school credit system.

There are still more instances of this: “As predicted, in comparison to mothers of boys, mothers of girls thought that their child was less talented in math in comparison to other subjects, that their daughter had to try harder in math in the absolute and in comparison to other subjects” (pp. 327–328). This shows the feminine position, objecting to the phallus. It also shows the contingency of the masculine-quilted-speech apropos of girls. However, at the level of ideology, the role of the phallus is being sublimated by the researchers, instead affirming that there is some “anxiety” (apropos of the phallus) about their daughters being able to accede to the masculine-quilted-speech and its market demands in school. This, in turn, affirms that the opposite is the case for the masculine pole in the Formulas of Sexuation.

Consider, moreover, this elaboration the authors make on the preceding claim: “Mothers of sons gave math talent a higher rating of causal importance for their child’s math success than
did mothers of daughters. In contrast, mothers of daughters gave effort a higher rating of causal importance for their child's math success than did mothers of sons” (p. 328). Ideologically, I see this as maintaining a neoliberal position, that the girls must put forth “effort” in response to the phallic demands of the masculine-quilted-speech qua success in mathematics.

Perhaps the most salient evidence of my critique can be found in this excerpt, which is quite literally saying that the authors are affirming their enjoyment of the masculine-quilted-speech:

[M]others of daughters rated effort, by a substantial margin, as the most important reason for their child's math success; talent came in a distant fourth after teacher help and employment. In contrast, mothers of sons rated teacher help and enjoyment as the two most important explanations, while both effort and talent came in a close third in terms of relative importance. (pp. 328–329).

In all the preceding, the ideological “differential” between talent and effort perfectly describes the masculine-quilted-speech apropos of biological sex. Again, these researchers are not talking about gender, they are ideologizing sex in order to posit claims about gender. This ideological commitment provides psychic protection against acknowledging that this study is more accurately a study concerned with advancing girls’ accession to the masculine-quilted-speech and the market, rather than being concerned with the “cruel optimism” relationship the daughters must engage with mathematics through (see also Berlant, 2011).

There is, still, more evidence in the article: “Like mothers, fathers tended to rate ability as a relatively more important explanation for sons' math successes, but effort as a relatively more important cause of daughters' math successes” (p. 329). I interpret this as being because the
fathers maintain the masculine phantasy that their sons are inherently more phallic, and thus “more talented” when accessing the masculine-quilted-speech.

To conclude, consider this excerpt:

Although boys and girls were doing equally well according to achievement test scores and math grades, mothers and fathers held different beliefs about sons' and daughters' math ability and effort, different expectations and performance standards, and different causal explanations for achievement outcomes. (p. 330).

This illustrates the “cruel optimism” (Berlant, 2011) relationship for the girls to mathematics, and despite this cruel optimism, the girls have been “successful in their failure to object” to the masculine-quilted-speech demands; thus, the girls have, through their cruel optimism relationship to mathematics, become more like men and have thus been able to achieve at the same levels, despite this achievement being “attributed” to effort rather than talent. The daughters have “worked for it” and have been able to maintain their “effort” through cruel optimism.

11 Kimball (1989) (Second Epoch)

This article problematizes a potentially gendered aspect to two types of achievement measures: course grades and standardized test grades. While it is, at first glance, admirable that the author suggests that “achievement” may produce different insights apropos of gender depending on the modality of assessment (whether that be overall course performance or standardized test performance), the article nonetheless makes several ideological commitments that, in the end, avow the MQS. First, consider this excerpt that frames the motivation for the article:
When sex-related differences in mathematics achievement are measured using grades in mathematics classes, the results are opposite to those found using standardized achievement tests. When differences are found, they almost always favor girls, and these differences are quite consistent across samples of varying selectivity for junior high through university mathematics courses. During the junior high and high school years, the most common finding is that girls achieve significantly better math grades than do boys. … Either female superiority or no sex-related differences in mathematics grades continues at the university level. (pp. 199–200)

This framing seems to indicate how the discourse about sex-related differences in mathematics is essentially a hysterical discourse (see Lacan, 1991/2007b), which indicates that the “issue” being sensed by researchers is actually about something else.

For example, consider this theoretical orientation of the article’s motivation: “[T]he balance of evidence clearly does not support the explanation that female superiority in math grades is due to greater sample selectivity” (p. 201). This indicates to me that woman is not-All (see Lacan, 1975/1998). To my reading, this is another indication that researchers are “stumbling across” some of these indicators in various formats (such as quantitative or psychological), but in many cases, the theoretical paradigms and ideological commitments of these researchers render these indicators “stuck” within the paradigm that found them.

Further, “girls receive their better grades in classroom situations that are less than conducive to their learning math” (p. 201), which shows women’s determination to accede to the masculine-quilted-speech despite the extra burden it puts on them. Even further, “boys receive more of the teacher's attention; teachers interact with boys, particularly high achievement boys, more than with girls, and boys are more active in providing answers, particularly unsolicited
answers, than are girls” (p. 201), which seems to indicate the “desire for the phallus” as the
transcendental condition that enables the masculine-quilted-speech to expand so prolifically (see
section I.6).

Next, consider the researcher’s statement that “In all of the above studies in which both male and female teachers were studied, there were no effects of the sex of the teacher; that is, both male and female teachers gave more attention to boys” (p. 202). Teachers desire the masculine-quilted-speech to shield themselves from the psychic trauma of serving as judge (see also Baldino & Cabral, 1998, 1999); I discuss this further in the analysis of Tiedemann (2000; see section IV.17).

In the same spirit of some of the other artifacts analyzed from this Epoch, this artifact indicates the role of failure and the feminine:

Girls' experience in the classroom appears from the preceding review to be one of relative
deprivation when compared with boys' experience. Given that girls receive better math grades, it would appear that they do so in spite of classroom experiences that might be expected to correlate negatively with their performance. … The female superiority in math grades is often ignored or dismissed in the literature on sex-related differences in mathematics achievement. (p. 202).

This is an important insight; it seems to support the notion of the feminine position as “knowing” they are in the position to object (S(A)). In acceding to the masculine-quilted-speech and passing their classes anyway, the feminine position of S(A) is effaced by the school credit system. This seems to be in alignment with the ideological character of the Epoch.

The author indicates further how the school credit system might be the true culprit, in the following excerpt: “It is hard to believe that receiving more As in advanced high school
mathematics is solely or even primarily due to these highly talented girls' better conduct and demeanor” (p. 203). I would agree and interpret this psychoanalytically as saying in spite of the traumatic effects of trying to masculinize their speech and accede to the masculine-quilted-speech, the girls are still able to appear to researchers as polite and well-mannered, demonstrating the behavior of the masculine-quilted-speech, through which they are thus able to get more As. They continue: “[O]ne might hypothesize that if math grades reflect rote learning more than standardized tests do, such learning patterns might be used to explain women's better math grades” (p. 203). This supports Moore and Johnson’s (2022) hypothesis regarding similar outcomes in a separate study (viz. Johnson et al., 2020).

Notwithstanding these insights, there are several neoliberal commitments made by the author, such as in statements like the following:

> Although there is ample evidence of young women's superior math achievement when grades are used to measure achievement, they have not been considered seriously in the literature on mathematics achievement. I am proposing that it is important to begin to take them seriously. Although I am not arguing that grades can or should replace standardized achievement tests, I would urge researchers and educators to consider examining and using grades as well as standardized achievement tests to evaluate knowledge of math. (p. 203)

By avowing the role of grades as proxies for “achievement”, such a claim is very neoliberal, and furthermore, this author commits theirself to evolutionistic thinking as well, assuming that this “alternative” view of assessment measures will still lead to a “reversal of sex-differences” and the ways they are interpreted. I still see this as affirming the masculine-quilted-speech and
showing how girls’ achievement in math course grades can be used to support the hypothesis that they can still be considered “as successful as boys,” given the impetus of this Epoch.

Next, consider the following excerpt:

The second reason for taking sex-related differences in mathematics classroom grades seriously is that grades offer one of the best ways to ensure that boys and girls have comparable prior experience. Because only classroom learning is tested, experiences in other courses or outside the classroom potentially do not influence the results as much as when a standardized test is used. The third reason is a practical one. The information that girls are not at a disadvantage and actually have an advantage in many courses in terms of class grades could be most useful in increasing girls' confidence in their own math abilities. (p. 203)

This demonstrates a commitment to neoliberalism and evolutionism, by essentially saying that “Girls can be just as confident, if only they are supported to be.” It seems as if the researcher is talking more to her colleagues and their undertaking of gender research, rather than to the girls she is attempting to “help.” Overall, this seems to be a bit confusing: the author seems to be interested in affirming that “woman is not-All,” but then reverses the thrust of the article to advance the assumption that girls will all want to have more confidence in mathematics. As such, this is an example of the masculine-quilted-speech “over-formatting” (or perhaps overdetermining) the feminine position, so that “woman” can be signified and quilted into the masculine-quilted-speech.

To conclude, consider the closing sentence of the article:

Perhaps what is most needed is an increased flexibility on the part of both boys and girls so that they may perform optimally across a wide range of achievement situations, as
well as increased flexibility in our views of mathematics achievement in order to accommodate the different strengths that each sex brings to the study of math. (p. 210)

It seems like the author is trying to “parse apart” some of the conflations that occur amongst the various "sex-differences hypotheses” that were, at the time, being advanced in the field. To accomplish this, the author seems to be engaging in some “critical apologetics” in order to not have her ideas rejected by colleagues. Overall, it seems that this author, despite having the foresight to engage in a critical analysis of the pervading theories of the time, still “enjoys” the achievement gap, because the thrust of her suggestions maintains the solutionistic premise of quantitative markers of girls’ experiences. Notwithstanding the author’s critique of the ways in which the pervading hypotheses of the time were being mis/used and mis/attributed by researchers of the time, there are some inherent paradoxes in what she claims, indicating that despite some indications in her analysis that she is sensitive to women as an anti-singular category, that she maintains that the ideological approaches of the pervading theories she critiques are in themselves above reproach and thus capable of being salvaged.

12 Miller et al. (1994) (Third Epoch)

This short article is concerned with standardized testing modality, and questions whether or not extra time on standardized tests benefits females. While this may appear to be aimed at developing an accommodation for students, I interpret this motivation as affirming the neoliberal position, that women should “want” to have higher scores so that they can enter the market at a higher position. However, the authors seem to be committed to critiquing the evolutionism inherent in the codified use of the SAT scores, drawing attention to how the evolutionistic use of the scores—to gain access to college admissions or scholarship opportunities—is inherently disadvantageous to women. Despite this, the theoretical perspective taken up by these authors
does not allow them to consider what is happening in the psyches of the women in the control versus experimental group. In other words, these authors are critical on the one hand, but seem to be unable to arrive at further insights because of the theoretical limitations they commit themselves to in this perspective. Because of this, the authors seem to be “enjoying” the masculine-quilted-speech via critiquing it. The masculine-quilted-speech is implicated in the fact that, when untimed, the women did better. I see this as evidence of the masculine-quilted-speech, because, for the women, the act of objecting to the masculine-quilted-speech—and then acceding anyway—causes a traumatic effect, which means their accession to the masculine-quilted-speech takes more time than for the men. The women are still approaching the SAT from the S(A) position, which means that they know there is no consistency to what the SAT signifies, and it is from this position that they can interrogate the phallus—but the men are “already there” so they can “easily” start quilting into the masculine-quilted-speech.

Consider this excerpt, which goes above the general claim of the article that the women significantly benefitted when the test’s time constraints were eliminated: “As suggested by the research, females are more inclined to be deliberate, and cautious problem solvers than males. Females are more inclined to use complicated algorithms rather than to quickly assess an item and estimate a solution” (p. 437). This really just “describes” the masculine and feminine positions on the Formulas of Sexuation, in that women—being more cautious problem solvers, and more likely to use complex algorithms—indicates that women are in the S(A) position, which is excluded from the masculine-quilted-speech, so they have to have extra time to perform their mathematical work “in the feminine way” so that they can masculinize and quilt into the masculine-quilted-speech. When given more time, this process seems to happen successfully, indicating that this may be happening in the psyche. However, the authors still ideologically
commit themselves to the neoliberal position that the girls can be as successful as the boys. This indicates the ideological thrusts of the epoch, especially in 1994. At this time, the great concern about gender and math was leading people to question the “extraneous parameters” that might be affecting girls’ performance, such as the testing modality and environment. However, the implicit enjoyment these authors are indicating in their speech is that “women can be just as successful, if they only are given more time.” At no point in this is the modality and/or role of the SAT at the level of political economy called into question. By not doing so, these researchers are in effect maintaining the role of the phallus (as the standard-bearing signifier of achievement, meaning “achieving” in the masculine way, i.e., “just as successful [as the men]”) in the masculine-quilted-speech, thus framing women’s “natural behavior” in the math testing environment as “being in need of additional accommodation and support.” This ideological commitment places the burden of performance on the women, which is a precondition for the ideological sublimation and thus continued reproduction and protection of the position of the masculine-quilted-speech in political economy.


This article represents an early instance of feminist theory being employed on the topic of gender and mathematics. The ideology critique I offer here should be understood in the article’s historical context: namely, that during the mid-1990s, the field of feminist studies was in a very tenuous position. There were not many academics who had stable tenure-track jobs in feminist studies or women’s and gender studies, and so one of the main tasks of these scholars during this time was to “water the seeds” that had been planted in the 1980s (Bonnie Zare, June 2, 2023, personal communication). In other words, advancing a feminist research agenda at this time was a task to be approached with caution and conservative decision-making. As a result, the
ideological thrust of this article does uphold many of the ideological positions I critique in the present study.

First, consider this excerpt: “Just because women can succeed in mathematics does not ensure that they will choose to pursue careers in this field. They also need to believe that they can succeed, and want to succeed” (pp. 311–312). This indicates a strong commitment to neoliberalism. Combined with the author’s espoused purpose of advancing “feminist pedagogy” in math ed, I am led to believe that the author is talking only about neoliberal feminism; which indeed she says herself when she admits she is basing this on the North American feminist project.

The author notes that “Changing the situation may call for a global approach in which men and boys need to be involved as well as women and girls. Schools can play an important role in encouraging women in mathematics” (p. 312). This is an excellent encapsulation of the primary claim of the present study, namely that research is often not about gender equity, but rather is about promoting more women to “become men.” This author even wants to recruit men into actively supporting this task as well. There is an ideological sublimation of the “complexity of the situation” by this author. The approach the author takes seems to affirm—as is the norm with much of the research from this epoch—the feminine position of $S(\mathcal{A})$ but then proceed by advancing arguments on how to “save women” from the feminine $S(\mathcal{A})$ “fate.” In other words, whereas the $S(\mathcal{A})$ indicates that the true feminine insight is knowledge of being a subject split by language, the artifact’s argument that—in effect—seeks to save women from this “split fate” suggests that there is some (masculine) suturing that can happen to create a whole subject. Belief in this is a masculine forgery because there is no whole, autonomous subject position—it is merely a masculine phantasy/aspiration.
Here is another example:

The resulting pedagogy may be called an inclusive pedagogy for it should encompass women not only as a social class but also as diversified socioeconomic and ethnocultural classes. It should also take into account the diversity of men and break away from the stereotyped male norm. (p. 312)

I read this as advancing a specific version of inclusive pedagogy, namely one based on the neoliberal feminist position that everyone can be successful in the market. The ideological commitment in the charge to “break away from the stereotyped male norm” is what allows this author to sublimate (after immediately suggesting it in her words) that woman is not-All. Breaking from the notion of male homogeneity is saying “men are also not-All,” but this allows for the “not All” position to be ideologically installed as normative in this author’s logic, thus ideological progress can only be made from this argument apropos of neoliberalism, which points directly to the masculine-quilted-speech as the referent for what this author is claiming to be “inclusive”—yes, “inclusive” into the masculine position, but this has nothing to do with “liberating women” from or interrogating those masculine bounds.

The author indicates the extent to which this neoliberal version of feminism is the motivation for the article, by citing the critical Marxist work of Freire but then tempering this by not including further discussions of the role of “woman” in political economy. During this epoch, as previously noted, the “cautious” approach to feminist theory which was being practiced by most North American academics at the time meant that, in their work, feminists were overall not talking about Marxist theory. In short, this provides an example of what I am critiquing in the present study. This symbolic engagement with critical theory leads to sublimation of the primacy of sexual difference in political economy, and thus affirms implicitly the school credit system
and the extraneous demands placed on women in that system to be able to be successfully
“included in mathematics pedagogy” (precisely the thrust of this article) qua acceding to the
masculine-quilted-speech.

Consider, still, this excerpt:

The situation of subordination in which women are viewed as having lost part of their
identity and self-confidence makes humanistic pedagogy attractive to the development of
feminist pedagogy. … [For example, professors can create] a climate of confidence in
which learning is meaningful for the students. (p. 314)

This again indicates the author’s ideological commitment to neoliberalism, because this framing
tries to “claw its way back out of” the role of the negative. It is interesting to note how the Fifth
Epoch has shown the pitfalls of such an approach, as the Fifth Epoch was more characterized by
an uptake of “more truly” critical approaches. During the Third Epoch, much of this type of
theoretical work was highly suspect in the North American context. Notable here, is how the
author calls for a humanistic education approach that can affirm and inform women’s and gender
studies. Note that humanism is excluded from psychoanalysis, and in turn is excluded from
psychoanalytic feminism, such as advanced by Copjec (1994/2015). Additionally, “affect” and
“cognition” are scientific (and thus masculine) signifiers. However, at the time, this
philosophical omission would have been “overridden” by the enjoyment of being able to believe
in and advance a pro-capitalist version of feminism. I make these comments to draw awareness
to the ways in which feminist theoretical commitments have evolved since the mid-1990s.

Another example of this distinction can be found in the author’s call for women
developing connections to “meaningful knowledge” (p. 315), which is an example of the
ideology that “woman can also know,” meaning that women can accede to the masculine-quilted-
speech, because the masculine-quilted-speech itself was not being interrogated by such approaches at the time. Note that what is excluded from this discussion includes the feminist notions of “refusing knowledge” and “refusing education,” which, properly speaking, are likely to be integral characteristics of what might be the feminine-quilted-speech.

The article drew some inspiration from a working group that the author had been involved with, and the author notes that the “members shared the same goal, that is, to see women use mathematics, work in mathematics, and/or contribute to the development of mathematics” (p. 316); this indicates how the feminist project at the time was ideologically pointing towards avowing and supporting the masculine-quilted-speech qua women’s “positive” participation in the field of mathematics.

Consider the author’s exploration of the notion of sexism:

[Sexism] happens, for example, when teachers and professors let boys or men monopolize class time and take more than their share of their attention. It happens also when girls and women are asked fact-based questions while boys and men are asked more complex and difficult questions. (p. 319)

Sexism according to Solar indicates the differential between assuming that the men already “know the phallus” as the transcendental condition for speaking in the masculine-quilted-speech. For women, the “fact-based questions” are testing whether or not the women have “assumed the phallus” (in which case they would be able to quilt into the masculine-quilted-speech) or are “interrogating the phallus.”

Or, consider how ideological avowals and disavowals are happening when the author notes that sexism can create “a chilly climate for women” (p. 319); I would agree with this, but the “chilly climate” created for women by the masculine-quilted-speech can still be seen as
holding the masculine-quilted-speech as the referent position. I would argue that this reproduces certain ideological commitments regarding feminism while ignoring other options that would be more in line with the psychic origins of gender, such as the distinctively feminine potential for refusal.

Next, consider this excerpt: “Discrimination is evident when professors favour a white, western, male perspective in curricular materials” (p. 319). I wager that this should be extended to include the quilted-speech of mathematics education, which is precisely the masculine-quilted-speech, because it is not only in the curricular materials that the masculine-quilted-speech is evidenced, but also in the act of participating in lessons and in the ways in which the “curricular speech” is reified by researchers due to the norms of academic publishing that privilege not only masculine ways of knowing but also masculine ways of “speaking” in the writeup of one’s research.

Despite these critiques, the article then takes a notable turn towards a different “tone” of feminism. For example: “[T]he language and humour prevalent in the mathematics classroom ignore women’s differences, thereby often resulting in disparaging comments. … Further, mathematics is commonly equated to intelligence but disability is not. This construct makes mathematics sound inaccessible to people with disabilities” (p. 320). This seems to affirm the “negativity” inherent in the masculine overdetermination of “woman,” which indicates that the author is trying to balance between advancing feminism in a “positive” way whilst avowing the “role of the negative” in between the lines of what she is speaking.

The author then links discrimination to language, indicating the “generic masculine language” (p. 321) that often infiltrates the discourse of a mathematics classroom. By linking this generic masculine language to the notions of universalizing experience only in the masculine
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

way, the author provides a lucid indication as to what the feminine-quilted-speech might entail. This indication continues and arrives at an astonishingly clear description of what the feminine-quilted-speech might be, including the roles of linguistic conventions:

Women are referred to as objects, in particular sexual objects. Jokes also tend to trivialize violence. This work reveals that sexist and racist humour is directed towards people holding an inferior status in society and plays an important role in maintaining them in this situation. The negation of women’s intelligence in humour, often combined with racist undertones, has to be viewed as an important side of classroom interaction. (p. 321)

This could very well indicate the foundations of the feminine-quilted-speech, namely that gender, race, and class are inseparable; in turn, this indicates the potential requirement to consider concrete universality (and thus, the role of the negative) in interrogating the masculine enjoyment of the “normal/typical” quilted-speech in mathematics education settings.

However, this “first attempt” at trying to articulate a basis for the feminine-quilted-speech may not go far enough. Consider this excerpt: “Ignoring these assumptions and premises [about the contributions of minorities] in mathematics, or in any other science, leads to the assumption, held by most mathematicians and non-mathematicians, that mathematics is neutral and that its teaching is value-free” (p. 323). I would push Solar’s work further, and wager that not only is this “neutrality” and “value-free-ness” not, in fact, neutral, but is actually masculine. This potential for Solar’s theorization “not going far enough” can be glimpsed by her claims regarding what teachers can do to “respect all students” (p. 323), which includes paying attention to all students, having expectations for all students, and so forth. My concern is that, in research on gender, if these values and goals are the accepted assumptions, then ideologically researchers are promoting the accession of women to the masculine-quilted-speech, rather than interrogating its
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

linguistic (and thus phallic) enabling condition—specifically, the transcendental phantasy condition of the masculine-quilted-speech where the masculine subject (S) phantasmatically attaches to an objet a.

For the time when this was published, I sense a tangible contingency with which Solar and likely similar researchers were trying to “water the seeds they had planted” during the 1980s and early 1990s. It seems likely that, for these feminists, a first step towards promoting a possible FQS—the desire for which is evident in this article as well—was to advance the notion that women are capable of masculinizing themselves in order to quilt into the masculine-quilted-speech. Ideologically, I am suspicious that, since the mid-1990s, that this “first step” has been ideologically installed in the field as the “goal”—which, as evidenced in this artifact’s avowal of characteristics of the FQS, is not in fact the goal, but is rather merely a “first step.”

14 Kloosterman et al. (2010) (Third Epoch)

This paper is another example in which the authors conflate gender with sex. The authors talk about gender, but really, they mean sex. Furthermore, the nature of the instruments used in the study are inherently masculine, because they employ scientism to represent “perceptions” about “gender” through quantitative signifiers, which themselves are ranked, thus indicating that whether or not the “masculine” position was on the low or high end of the scale, that the instrument was measuring something accumulable, through the use of mathematical signifiers. In other words, the quantitative representations of the instrument items represent a certain ideology (scientism) that is then quilted into the speech of the research participants in a masculine way, apropos of what the items were signifying at the level of the psyche.

For example, “The data indicate that, similar to findings from the 1970s, students believe that mathematics is gender neutral, although females hold this belief more strongly than males”
In light of the other evidence in this study, this claim seems to suggest that at the level of the psyche, something else is happening. These researchers are formatting the interpretations of their subjects though the masculine-quilted-speech, which would disavow the role of the phallus in conditioning the speech of the research subjects as well as the speech of the researchers in interpreting the subjects’ speech. By this, I mean that the “masculine nature of the mathematics education in school” is being overshadowed by the espoused beliefs of the subjects. If subjects “believe” that mathematics is neutral, then it levels the responsibility on the women to access what is ideologically posited by the researchers as a neutral-quilted-speech. However, my extension of the identity-quilted-speech concept from Baldino and Cabral (2018) indicates the phallic sublimation that would be needed to advance such a position.

Consider another excerpt:

Another study by [other researchers] found that high school students felt that mathematics was a gender-neutral domain although, to the extent that stereotyping existed, males stereotyped mathematics more than females. [The other researchers] went beyond previous work involving mathematics as a male domain when they noted that students who reported the least amount of effort in mathematics were the most likely to report gender stereotyping. (p. 149)

I interpret this as saying that men stereotype math as male more than females, and females are more likely to believe that math is gender-neutral. Because of the role of the phallus in installing the masculine-quilted-speech, this is to be expected. Moreover, I read this as biasing the concept of “math as gendered” towards accepting ideological bases that are masculine in nature.

In terms of the study reported by this artifact, consider this excerpt that describes one of the instruments used:
[The subscales on the instrument included] mathematics as a gender-neutral domain (e.g., “Students who say mathematics is their favorite subject are equally likely to be girls or boys”), mathematics as a male domain (e.g., “Mathematics is easier for men than it is for women”), and mathematics as a female domain (e.g., “Girls are more suited than boys to a career in a mathematically-related area”). (p. 150)

“Favorite subject” implies that they enjoy it, meaning that, if my hypothesis about the masculine-quilted-speech is correct, then what this item is asking about is specifically masculine enjoyment—regardless of the gender or sex of the student. “Easier” is a missed perception; because it is only applicable as a reference “internally” to one person, what might easier even mean? I suspect that, at the level of the psyche, what this question is actually asking about is the desire of the Other. If someone thinks “math is easier for men” then what they might appear to be communicating with that belief is that “the others around me are quilting into the speech of the classroom and/or discipline in a way that they seem to understand more than I do.” But, this is a failed recognition because the “appearance” of others as they quilt their speech is impossible to know. What is likely happening here is that the item is asking about the anxiety involved in the neurotic phantasy (Lacan, 2004/2014), where it appears that the subject “knows what they want” when they have the correct signifiers (in the form of objet a’s, in the case of the math classroom). This is an excellent illustration of the “Che Vuoi” injunction of the Symbolic order.

Next, consider the following excerpt that reports one of the key findings of the study:

Finally, it can be noted that the U.S. findings are very similar to those in Australia … The

---

68 The item is Symbolic, and thus draws on masculine enjoyment, because it asks the respondent to answer with a signifier (a number on the instrument scale), which means that the respondent’s answer is also Symbolic. By contrast, the Real begins to rear its head when, for example, one is reading a Likert-scale item and has trouble thinking they can assign a number to the given/signified statement. By “pushing through” this difficulty, the respondent enjoys masculine jouissance in signifying their answer despite their anxiety about doing so.
fact that secondary school females were stronger than males in their belief that mathematics was a neutral domain and not a male domain in both countries suggests that these beliefs are widely held in western societies. (pp. 156–157)

This finding, being similar between the US and Australia, captures the role of capitalism in producing the masculine-quilted-speech, namely, that it is under capitalism that the logic of the masculine-quilted-speech ends up being propagated as the logic of school mathematics. Taking the Formulas of Sexuation into account, these findings are perhaps to be expected. The role of the phallus in structuring masculine embodiment (and thus, also, in structuring masculine thinking) causes the phallic function to be experienced as a demand, precisely a demand for signification. When females believe “more strongly than males… that mathematics is not a male domain” (p. 155), we see the role of the S(A), the feminine position that interrogates the phallus by avowing the inconsistency of the social order, which was, in turn, installed by the phallus.

Finally, consider the concluding statement of the article: “The perception that boys distract other students from their work more than girls (Item 16 [on one of the instruments]), for example, reflects boys’ tendency to be more disruptive in school settings” (p. 160). The perception of boys as disruptive illustrates the phallic “intrusion” in overdetermining the social order. In terms of mathematics, this phallic intrusion indicates the extent to which the masculine-quilted-speech is formatting the social order under the capitalist mode of school. In addition, the authors of this study seem to be enjoying the fact that “perceptions of mathematics and gender are still an issue in pre-college and college classroom settings.” Many of their results, they state, mirror similar findings from previous decades. In this way, the authors are showing how their ideological commitments to studying this issue relate more to the Third Epoch, and thus it is tenable that the authors are enjoying the ideological commitments of the Third Epoch, namely,
enjoying a sort of “hysteria” about girls and math as indicated by the two 1994 reports I discussed in Section II.5.2. If this were not the case, then it would seem more likely that the authors would have elected to take a more critical perspective in conducting this study in 2010. The scientism inherent in the methods used for the study indicate an enjoyment of the masculine-quilted-speech and furthermore, an alignment between the ideological thrusts of the political context 15 years prior.


This article is another example of how researchers are conflating gender with sex, because the assumption that gender can be “read” intelligibly into categories—as the authors do in the study—is really just considering biological sex and then interpellating it into a consideration of “gender.” This ideological commitment is especially notable in this article because the authors are studying children as early as kindergarten, an age at which no one understands the process of becoming-embodied yet. Consider this excerpt:

[The results of the study show that] mean differences in mathematics achievement are visible as early as spring of first grade. This is significant because it contradicts the conventional wisdom that differences emerge later in students’ academic careers, and does so with nationally representative data. Second, we find that differences in the tails of the distribution arise earlier than the mean differences, and are visible even in the fall of kindergarten. (p. 246)

While the “social aspect” of this article’s focus does indicate how gender is Symbolic, the scientism with which the authors engage is indicative of the way the masculine-quilted-speech, being masculine in nature, overdetermines the “reading” of these sex differences. The appearance of sex differences as early as kindergarten indicates that both gender and
mathematics are functioning in the social realm, because it is in kindergarten that the earliest influences of the social order become evident in children’s development. However, by committing themselves to the ideology of scientism, they are relying on the role of the phallic signifier (which is masculine) in installing the quilted-speech they offer as the interpretation of this data. In other words, this study is a good example of how the masculine-quilted-speech takes “gender” as readable, and the differences are in themselves taken to be readable. Thus, the authors are committing to the ideology of interpellationism, which, in effect, “recruits” the subjects of their research into the masculine overdetermination of gender through an “ideologicaion” of sex. Examples of this can be seen in the authors’ use of terms such as “a stable gender difference” (p. 246). The masculine desire for this interpellation is indicated in the authors’ speech, such as the gender differences they detect as being “not exclusively a function of the educational system” (p. 246).

Indeed, as I theorized about the masculine-quilted-speech, it is the role of mathematics under capitalism that preconditions these “gender differences” in every aspect of capitalist life. In other words, the analysis posited by this artifact suggests that the authors are sensing the role of the phallus in installing the social order, and yet are also enjoying “gap gazing” at the differences they highlight as being at the bottom and the top of the data distributions they collected. This enjoyment of the gap gazing they found showcases the masculine desire for gender to be interpellatable, which in itself shows the role of the masculine-quilted-speech in reproducing the desire of gender researchers to find a difference which they can analyze through scientism and interpellationism. This ideological commitment maintains the masculine-quilted-speech as the referent position for the speech they quilt. What is the desire of quilted-speech such as this, if not to showcase the extent to which the girls are “disadvantaged by the phallus” and its
installation of the logic of capitalist accumulation in school mathematics? The focus of this artifact on the “differences” detected simultaneously avows the difference itself as an indicator of girls’ disadvantaged position in society, but also disavows that this “difference” represents a phallic interpellation of sexual difference. In other words, if these researchers found such profound “differences,” what is the consequence for the girls in the study if not to be highlighted for their disadvantaged position in the social order, rather than seeking to interrogate the social order through their research and emancipate the girls’ struggles in the capitalist mode of school? I read this as an example of what Pais (2012) has described as being the adjustment that happens to liberatory discourses in order to support the capitalist mode of school.

16 Hanna (2003) (Fourth Epoch)

This article is primarily a research commentary on large-scale data sets (e.g., TIMSS). One claim that this article draws attention to is the apparent “end of gender differences” (p. 209). If gender differences have “ended” in mathematics education, then what is the reason for the lingering beliefs about the gendered nature of the discipline itself, such as is more evidenced in men’s beliefs? And further, what is the role of researchers in considering how certain interventions (such as pedagogical interventions) can “re-introduce” gender differences? I would wager that this “decreasing gender gap” in terms of mathematics test scores (as captured by studies like the TIMSS), indicates that in terms of acceding to the masculine-quilted-speech, women have indeed been successful. I worry, however, about what is being excluded from the speech of these women for whom equity in achievement has been reached. Could it be the case that the influence of the feminine-quilted-speech has in fact been completely repressed? This could be the reason that, despite eliminating the gender gap in achievement, that women still feel “gender pressure” when, for example, working in mathematical fields. This pressure, as indicated
by the masculine-quilted-speech, could explain why, despite having perhaps achieved the same mathematics outcomes during their school and university years, that women still do not feel that the field of mathematics is feminine enough in nature, once they are working in a professional role.

The article also discusses the notion that “equity of outcome [can be represented by] equality in representation” (p. 210). I am suspicious of the notions of “equity” advanced by this author, for example, what ideological commitments are present in the use of “percent of women enrolled in university” and “equity in mathematics achievement.” In both of these cases, which represent the main theoretical messages of this article, the logic of the masculine-quilted-speech is present. In this way, the author seems to be enjoying the “success” of women as indicating a decrease in gender discrimination. However, would this not also be the case, that there could be interpolated a “decrease in gender discrimination,” if it was actually the case that the women were, through acceding to the masculine-quilted-speech, becoming more masculine? There would, if that was the case, indeed be a decrease in discrimination, but not an avowal or advancement of the feminine position. In the mere fact that the data utilized in this study is quantitative data, there is evidence of the masculine-quilted-speech.

Despite this, the article does seem to indicate the ideological character of the beginning of the Fourth Epoch, because the article ends with an explication of the “non-homogeneity of boys” argument, indicating that, at a psychical level, the phallus is still “signifying its demands” insofar as the masculine-quilted-speech is still the referent hysteria for gender researcher in mathematics education. The masculine-quilted-speech is still demanding its accession, despite the fact that, as it turns out, not all boys are equally capable themselves of satisfying its phallic demands. Could it be that, for some boys, the phallic signification that installs the masculine-
quilted-speech in the social order is starting to “detach?” Is the masculine-quilted-speech starting to, instead, signify other things in school? If so, then the uptake of “boys’ equity” research in the Fourth Epoch may, in fact, be more concerned with re-signifying the masculine-quilted-speech for all boys, which, as with the issue of girls’ equity, is not so much a call for equity as it is for homogenization. This seems tenable, amidst the prominence of the STEM ideology that has pervaded school since the turn of the century, which maintains a “hysteria” around mathematics achievement; if the boys are now the ones who are demonstrating a tenuous relationship with the masculine-quilted-speech, then it could be the case that the phallic demands of the masculine-quilted-speech are still maintaining “one version” of masculinity, which would precisely reference the “mathematics for all” injunction that the STEM ideology of the 21st century is continuing to avow. By contrast, what would the situation be for mathematics education, in light of this “boys’ equity” concern, if, for example, creative writing and literature were considered as highly important for high school graduation and subsequent insertion into the capitalist market economy? Again, here, I sense an ideological devotion to the masculine-quilted-speech and a disavowal of the fact that it is the relations of production that determine the development of mathematical ideas (Sohn-Rethel, 1978).

17 Tiedemann (2000) (Fourth Epoch)

This article begins by stating that, “It is the aim of this quantitative field study to test for perceptual bias in teacher expectations about gender in their teaching of mathematics at elementary schools” (p. 191). “Perceptual bias” is an interesting concept from the Lacanian perspective. On the one hand, it affirms the sinthomatic nature of gender, serving to represent the self in a particular way in the social order. Thus, a constitutive “desire of/for one’s gender” is indeed aimed at perception. However, on the other hand, what could “perceptual bias” mean, if
not indicating the roles of the feminine and the masculine with regard to the phallus? In terms of
the psyche, all people experience both poles of the Formulas of Sexuation, meaning that there are
no purely masculine individuals nor are there purely feminine individuals. Rather, since the
masculine and feminine poles logically regulate how each person becomes embodied—and thus
how each person develops their desired form of representation and perception in the social
order—there is always a “bias factor” that has been installed by the phallic signifier. For this
reason, this article is interesting because it seeks to determine the extent to which bias serves as a
self-fulfilling prophecy.

Notwithstanding this, there is a psychical issue with the notion of “attribution,” which is a
key concept in the article. The issue is namely that the paradigm of psychology, wherein the
notion of attribution has been developed, relies on a belief of readable signification, that a
signifier can represent itself, and that the researcher can “read” the research subject. This is an
example of the effect of the ideology of interpellationism, itself underpinned by the ideology of
scientism. This article seems to be committed to both. As Althusser (see Morel, 2023) has
indicated with the act of interpellating, the danger of this ideology is that, by believing that the
subject can be read, it seeks to recruit subjects into the same ideology. In other words, this study,
through interpellationism, runs the risk of recruiting its subjects into the same quilted-speech it
tries to analyze. Said another way, the philosophical basis of psychological notions such as
attribution function through retroactive justification (through interpolated reading) of the validity
of the concepts they seek to investigate. An example of this concern can be seen in the notion,
employed by the authors of this article, of the “sustaining effect,” which they define as when
“teachers fail to recognize students’ potential and hence do not respond to them in a way that
courages them to fulfill their potential” (p. 191). While this sounds well-intentioned, is it not a
reference to neoliberalism and evolutionism, in that it references a belief that all students wish to
do well in mathematics, and that doing well in mathematics is itself a sovereign good? I would
argue that these point to the capitalist mode of school, itself being written in masculine-quilted-
speech, and not to the actual gender of the students that the study takes as its unit of analysis.

The article states that there are three types of factors on which the author analyzes teacher
beliefs: (1) assessment of abilities and effort, (2) causal attributions of multiple achievement
outcomes, and (3) expectations of future achievement. All of these factors indicate the
ideological commitments of the author, for example, that children’s abilities and effort signify a
“positive” dimension of their experience in mathematics without regard for the reasons their
abilities and effort may not produce desirable effects in the capitalist mode of school. For
example, the child’s psychical life is not considered in these dimensions. The second factor,
attributions of achievement outcomes, indicates a distinctly neoliberal commitment in the
perspective of the authors, that achievement is the ideal, and that causes for achievement can also
be “positively” attributed to reasons, indicating a commitment to interpellationism, in that the
child’s labor-power “read” and thus qualified. Finally, the “expectation of future achievement”
dimension again commits the neoliberal belief that underpins the capitalist mode of school,
focus only on the “positive” aspects of what can come from children’s labor: maybe
intellectual labor, and maybe manual labor (Sohn-Rethel, 1978). Within the masculine-quilted-
speech of the capitalist mode of mathematics education, labor-power is only qualified if it is
masculine, because it is only through the masculine enjoyment that “positive” mathematical
signification can be performed and thus qualified as successful by teachers. This creates a
conundrum for the girls: the “gender” dimension of this study refers to the extent to which the
girls can masculinize themselves enough in order to “expect future achievement” in the same
capitalist system. Since this study is considering teacher beliefs, I interpret teachers as desiring the masculine-quilted-speech in order to shield themselves from the psychic trauma of serving as judge (see Baldino & Cabral, 1998, 1999). In other words, mathematics teachers and (many) mathematics education researchers want the masculine-quilted-speech for themselves, because they enjoy the masculine-quilted-speech; it provides psychic stabilization against the traumatic nature of being the judge of who passes and who fails (see also Straehler-Pohl & Pais, 2014). The masculine-quilted-speech qua accumulation supplants and effaces this “judge” capacity; teachers and researchers get masculine enjoyment because the masculine-quilted-speech legitimizes the signifier “judge” in the Symbolic.

Next, consider the five dimensions on which the author states they would “expect boys to get more favorable assessments” (Tiedemann, 2000, p. 194). The first is “teachers’ assessments of students’ underlying mathematical abilities” (p. 194); in this case, the teachers are engaging in the masculine-quilted-speech, because qua Symbolic, the masculine-quilted-speech provides a shield against the psychic burden of serving as judge in the capitalist mode of school. By sublimating this burden and instead signifying “students’ underlying mathematical abilities,” the author is taking mathematical ability as the objet a, on which the phallic function acts in masculine phantasy. Note that the author takes the students’ gender as a given, readable position, and in this way, they are conflating gender with sex, as is common in much of the literature analyzed in the present study. Ideologically, the issue with this conflation is that gender is avowed here as an interpellatable signifier in the social order, and not as a sinthome, wherein the latter would indicate an encounter with the Real. By fixing the meaning of “gender” purely in terms of the symbolic order, the author is rendering the concept of gender as only readable through the Symbolic, which, being composed of signifiers, is masculine.
In the case of the second and fourth dimension—“teachers’ causal attributions of students’ current … and future … achievement in mathematics” (p. 195)—there is an ideological retroversion of causality, implying that achievement is the result of a sequence of events, and is thus attributable to something. The only true “causal” event that would lead to students’ current achievement is the production/loss point in the hysteric’s discourse (Lacan, 1991/2007b), where the student just hopes for luck when the summative assessment time comes around (Baldino & Cabral, 1998, 1999). The production/loss point in the hysteric’s discourse is a master-signifier (Lacan, 1991/2007b); could this master-signifier be the phallus? I wager so, because it is the hysterical production of “hope” in the student’s psyche that is the only transcendental of their “current achievement” in psychic reality. However, by committing their self to the ideology of interpellationism and neoliberalism, the author is indicating that the Symbolic is readable/interpellatable, and thus causation of events can be read and understood. The only quilted-speech wherein this ideological commitment is tenable is within the masculine-quilted-speech, and furthermore, the reality that the hysteric’s discursive arrangement, which is in itself the “last word” in the pedagogical process of mathematics education—despite research literature claiming it should not be (Baldino & Cabral, 1998, 1999)—is itself more feminine in nature doubly forecloses any alternative to the masculine-quilted-speech in interpellating “teachers’ causal attributions of students’ current achievement in mathematics” (Tiedemann, 2000, p. 195). It is the “hope”—what might be a “hopeful desire for the phallus”—that then enables the masculine-quilted-speech to reproduce itself, and though so reproducing, produces students into the masculine-quilted-speech of capitalist accumulation as agents of school accreditation.

In the case of the third dimension—“teachers’ attributions of students’ fictitious, unexpected achievements in mathematics” (p. 195)—there is an inherently masculine jouissance.
Fiction and reality are a dialectic (Walshaw, 2004), which is why, for example, Lacan (2013) says that “Truth reinforces in [itself] the structure of fiction” (p. 334), because in the psyche it is truth and reality that form two out of three “external” supports for psychic life (the other being object-causes of desire; Lacan, 1975/1998). These “external” supports are, of course, not actually external, but they are experienced as external as they are quilted into the language of the unconscious. The true, signified by $S(A)$, is the feminine/Real anchor; reality, signified by the phallus, is the masculine/Symbolic anchor. However, the true is nothing more than ideology and its perception (Lacan, 1967/n.d.-b). The third anchor, the objet a, is inherently egoic, having arisen from the mirror stage, and thus ties the masculine and feminine anchors together by enabling the phantasy of the subjective plane. This phantasy is inherently masculine (signified by $S \rightarrow a$) which turns out to be the transcendental condition for the masculine-quilted-speech. So, how should we interpret this third dimension? Since fiction and reality are a dialectic, together constituting the subject, it is in reality that the phallus “cuts through” the Real (the source of jouissance that is inherently feminine) to sublimate the perception that the social order, the Symbolic, is complete. This is a phallic imposition onto the otherwise feminine nature from whence all of us came. Lacan (1967/n.d.-b) says it succinctly: “Simply there is no male without a female. This is the order of the Real” (p. 169). This dimension called for by Tiedemann, seeks to conflate the “fictitious, unexpected” aspects of the students with the neoliberal signifier “achievement,” the latter of which indicates the masculine-quilted-speech. In other words, I interpret this dimensional criterion espoused by Tiedemann as saying what Lacan elucidates as the masculine phantasy of creating the subjective plane, wherein two bodies may become one: The masculine-quilted-speech “plus” Woman is an attempt at generating this subjective plane, but it does so in the masculine way because “Woman” is itself part of the masculine-quilted-
speech. However, this is to be expected, because, as Lacan (1967/n.d.-b) states: “[Her] body becomes the metaphor for [his] jouissance” (p. 243). In other words, the “mixing” of the signifiers of fiction/unexpectedness and achievement is a masculine imposition to seize the feminine enjoyment and quilt it into the masculine-quilted-speech. Or said another way, “her fiction” becomes a metaphor for “his achievement.”

The fifth dimension—“teachers’ perceptions of students’ self concept of mathematical ability” (p. 195)—is an exercise in pure ideology, in light of the previously mentioned alignment by Lacan of ideology and perception in the symptom. My critique of this dimension is homologous to my critique of the first dimension (see above), with the additional caveat that this fifth dimension evidences the role of the symptom in teachers’ (symptomatic, yet sublimated) evaluation of what students think of themselves whilst quilting into the masculine-quilted-speech. Again, as I stated above, this is due to the role of the masculine-quilted-speech in shielding teachers’ psyches from the burden of serving as judge.

18  Q. Li (2004) (Fourth Epoch)

This article suggests an extension/reworking of an existing cognitive model as a way of understanding gender in mathematics. “Cognition” is the basis for this model, which theorizes that gender is “cognizable” meaning “readable” and thus interpellatable. By conflating the “cognition” required to make sense of the signifiers of mathematics, this author is assigning the masculine-quilted-speech’s logic to “read” gender, which, according to this model, renders gender as only readable through the masculine-quilted-speech. Furthermore, since this is a quantitative model and thus a quantitative study, the author is committed to the ideology of scientism, which is underpinned by the ideology of interpellationism. For this reason, the ideological commitments of the author are not in conflict with each other; but they are in conflict
with the psychic nature of gender. In other words, this article is another example of the masculine overdetermination of gender, thus creating an exclusionary effect. However, given the ideological thrust of the Fourth Epoch, it seems expectable that efforts were being made to consider the beliefs of teachers and students, to problematize beliefs that not all students could succeed. As I have shown in other critiques in the present study, such an ideological commitment does not actualize the pursuit of equity, but rather advances an agenda of homogenization to the capitalist and masculine position in the quilted-speech of mathematics education.

19 Van de gaer et al. (2004) (Fourth Epoch)

During the Third Epoch (the previous epoch to when this article was published), there was a push for avowing girls’ potentiality in the capitalist mode of school—a neoliberal commitment par excellence. That push, as avowed by this article, showed that girls were in fact able to achieve in the masculine way, and that by the time of this study, they were in fact “outperforming boys” in mathematical achievement. To protect the phallic position of the masculine-quilted-speech, the expectable reaction to girls’ accusation to the masculine-quilted-speech was, inevitably, the re-avowal of the need for boys to also do well. Ideologically, this reinvigoration of the need to address boys’ underachievement indicates the extent to which Capital—as a master-signifier—serves as a semblance of the phallus. In other words, the thrust advanced by this article to consider how sex segregation in classes might enable a greater concentration of the masculine-quilted-speech in the Symbolic/social order of the classroom, thus potentially leading to a way of addressing the phallic desire for boys to signify in the masculine way. The “greater variability” hypothesis for boys, as explicated by some previous researchers, and further taken up by this article, shows that the “gender differences” argument, even for boys, is not concerned with aspects of failure, but rather—for both boys and girls—
serves as an agent of capitalist accumulation in the form of mathematics achievement. In other words, once the girls are “doing better than boys,” the next step was to get the boys to do “better than themselves,” meaning that, at the level of ideology, the enjoyment of pursuing such a line of scholarship retains the masculine-quilted-speech as the ideal, rather than avowing the material conditions under which the students labored to produce the desired form of labor-power (which is itself masculine). This is further evidenced by the fact that this article is a quantitative study, thus committing interpellationistic and scientistic “misreadings” of gender and mathematics.

20 Knowles (2008) (Fifth Epoch)

With this article, a marked departure from the quilted-speech of the past Epochs is immediately glimpsed: the focus on relationality and counseling. Relationality avows the dialectical nature of gender, and counseling avows the Analyst’s Discourse (Lacan, 1991/2007b) which is a discursive arrangement that produces master-signifiers; thus, the Analyst’s Discourse is a unique discursive arrangement that has the potential to “reveal” the role of master-signifiers by producing and thus losing them.

Much of the analysis in the article hinges on applications and elaborations of Freudian theory, such as “the promise of psychoanalysis in its attention to the unconscious and the present effects of the past on everyone” (p. 674) and how “relational psychotherapies share the premise that humans are hardwired for relationship, which provides the essential motivation for all human activity” (p. 674). It is notable that this article appeared in ZDM, a leading mathematics education journal; I interpret this as indicating a markedly different characteristic of the Fifth Epoch, because as an invitation-only journal, the special issue editors would have sought this article out and/or been involved in ensuring its cohesion with their vision for the issue. In particular, this article was based on the author’s doctoral study, which concluded by noting the
role of gender in “the ways [the author’s] counseling participants and [the author] related to one another, which I [the author] suggested should be subject to future research and analysis” (p. 676). Ideologically, this article does not focus on achievement, instead focusing on the relational mechanisms that participants employed to “protect underdeveloped mathematics selves: typically overconfident grandiosity and/or resistance in the men and underconfident depression or anxiety and troubled tutor attachment relationships in the women” (p. 673). This nuanced approach, notably different than other artifacts I have analyzed in the present study, signifies a conception of gender that does not presuppose an evolutionistic attachment to the masculine-quilted-speech as the ideal of mathematics education and gender research. Rather, and although the author does not say it, this article advances a conception of gender that is more in line with the dialectical nature of the masculine and feminine enjoyments as Lacan (1975/1998) theorized through the Formulas of Sexuation. Specifically, I am referring here to the ways that the masculine and feminine positions are a dialectic, and one that has fundamentally different characteristics on each side. The masculine side I have sufficiently described in the preceding analyses; the feminine side aligns more with what this author is advancing: namely, the “traumatic effect” of acceding to the masculine-quilted-speech qua mathematics achievement in the capitalist mode of school.

By advancing a focus, instead, on the feminine aspects of relationality (which is enabled through the feminine signifier S(A), that the Big Other is itself barred/lacking; see Žižek, 1989/2008a), anxiety, and depression, this article advances a conception of gender that enables a closer look at the role of failure. In my view, this indicates a key component of what a feminine-quilted-speech might entail. However, there is still a possibility that this article does not go far enough in terms of interrogating the masculine nature of the capitalist mode of school, primarily
through an avowal by the article of the “positive” aspect of developing the “mathematical self,”
which I read as advancing a development of “identity.” In other words, while this article does advance the role of failure, it does not seem to advance an aspect of “refusal” of mathematics. I wager that both of these are likely to be key aspects of the possibility of a feminine-quilted-speech. Regardless, this artifact does seem to reflect the growing “disconcert” of the transition from the Fourth to the Fifth Epoch, namely that after the 2001 terror attacks on 9/11, the question of American Exceptionalism was beginning to be interrogated as to the extent of its role in world political economy. The next artifacts I analyze from the Fifth Epoch show how this concern was continuing to increase since the years of this artifact’s publication. Overall, this article represents a significant milestone in advancing an interrogation of the previously avowed conceptions of gender research in mathematics education—that the privileged position of the masculine jouissance in gender equity research should be called into question. This is perhaps most evident in the way that this author showed, through the use of psychoanalytic and counseling theory, that the psychic structure of the family (in particular, the role of the phallic signifier in instituting language and law) manifests in the teacher-student relationship. Such an important revelation is no doubt a key landmark in showing how the phallus installs the (distinctively masculine) quilted-speech of mathematics education.

21    Esmonde et al. (2009) (Fifth Epoch)

This article is notable because of its appearance in the second volume of the Journal of Urban Mathematics Education. This journal, founded in 2008, indicates a growing concern in the mathematics education field about the extent to which the field was taking critical issues seriously. The ethos of the journal is one that privileges distinctly critical analyses, so there is evidence in this article, qua ideological artifact, that a shift in the overall ideological character
between the Fourth and Fifth Epochs was taking place. In order to appropriately study ideological products, such as gender, ideology must be a foundational aspect of the theoretical perspective. In this article, we see that being the case, as the article’s “analytic lens [is] informed, in part, by critical race theory” (p. 18).

The article “considers how students’ identities (their own identities, imposed identities, and the ways they identify others) are made salient in the narratives they tell about their mathematics classroom” (p. 24). This indicates two nuanced ideological commitments: on the one hand, the conception of identity employed by the article avows the ways in which identity is, in the Hegelian way, a dialectical concept imposed by the social order, although the authors do not say it this way. This distinction is important because it opens up the possibility for such research to consider the role of concrete universality in determinations of “identity” (see Žižek, 2018). On the other hand, the article assumes that identities are readable insofar as they conceive of “each student [living] at the intersection of multiple forms of identity, and would have a unique perspective on classroom group work that was shaped by these identities” (p. 25). I see this conception of intersectionality as a useful persuasion that the role of identity in the social order is important for complicating the belief that people’s identities are readable (see Morel, 2023). In the realm of political economy, these “positive” determinations of units of analysis (such as a student) are a possible first step in revealing how hegemony operates against the inherent “unreadability” of desire. By this, I mean that it is important on the ethical level to advance an intersectional understanding of identity, but at the psychical level this line of argumentation does not go far enough in avowing the role of the “negative” in undermining identities themselves.
So, on the one hand, this article offers a potential indication to what type of quilted-speech may challenge the masculine-quilted-speech, but I do not think that the article goes far enough in explicating that this quilted-speech could possibly be feminine in nature. However, this is perhaps the result of the ideological character of the field at this point in history. It was at this same time that the transgender debate was reaching a critical consciousness; as a result, approaches to gender research that critiqued the dominant capitalist mode of education research were proceeding with relative boldness but also with a distinctive air of caution and reservation. In other words, in this article, I sense a distinctive avowal of the role of critique, specifically of critique of dominant ways of knowing in the capitalist mode of school, but I also sense a hesitation to further consider the role of concrete universality that would be undermining the conception of “identity research” such as this. Or said another way, I am suspicious that conceiving of gender as a “philosophically positive” concept such as “identity” would not be able to lead to a conception of a distinctively feminine quilted speech. Nonetheless, the article does a compelling job of showing how gender and race are intricately connected; although the authors do not say it, there is an inherent critique of the Symbolic order—which, under the mathematics education context analyzed by the article, is an inherently masculine and White order.

To be clear about my concern here, I contend that the promotion of the “positive” aspects of identity, which is accomplished through the use of signifiers in order to be considered “readable” under capitalism, still leaves open the ideological likelihood that concrete universality will not be actualized as a result of such research. If identities are posited as positive and readable, then the capitalist mode of school can continue to function as the hidden masculine referent for the quilted-speech of those students who are considered to be producing the desired
and qualified form of mathematical labor-power (Sohn-Rethel, 1978; Baldino & Cabral, 2013, 2015). In avowing the positive aspect of identity, is it possible to “enjoy the signifier?” Enjoying the signifier would entail that the signifier has been sublimated (Lacan, 1986/1992), which is indeed the function of ideology. Therefore, I suspect that the promotion of identity-based gender research has the potential to reify the capitalist mode of school, allowing gender to proceed as an agent of capitalist accumulation (see also Martin, 2021) through the mechanism of the masculine-quilted-speech. In short, is it likely that this study will lead to real changes in the experiences of the [bisexual and lesbian, non-White] students interviewed? Or will the capitalist mode of school, with its masculine-quilted-speech, continue to serve as the referent position for all non-White and non-cis-male students when they are trying to be successful in mathematics?

22 Llewellyn (2009) (Fifth Epoch)

This article employs Foucauldian theory, feminist theory, and poststructural theory; this perspective indicates some interesting ideological commitments that are afforded and restricted in research on gender and mathematics, and its situation at the cusp between the Fourth and Fifth Epochs is notable. Consider this excerpt:

By deconstructing gender I am questioning the assumptions that are made through hegemonic discourses. This of course is a step towards social justice for both ‘men’ and ‘women’ within the mathematics classroom, as it is argued that both should be able to perform as the ‘other’ as feminine or masculine, respectively. (p. 413)

I read “deconstructing gender” as considering gender as a symptom, and an agent of phantasy. For this reason, yes, this approach would benefit both men and women.

The author states that mathematical discourses themselves are gendered, and that this gendered effect of discourse impacts identity development. The dialectic of “normali[zing] (or
not)” (p. 413) indicates the ideological commitment of the author to what appears to be a position on identity that aligns with Hegel’s notion of identity that incorporates its negation: difference. This “inclusion of the negative” in the theoretical perspective of this article marks both a notable change as compared to the work of past epochs, and also opens up the possibility that the approach advanced in this article can address the issue of concrete universality in gender and mathematics research. Note the importance of this distinction: namely, that there is no evolutionistic assumption about the research, and also that there is no attempt to read or recruit the subjects’ genders into the interpellationist ideology that is pre-requisitely required for scientistic research. Because of this, there is a distinctively different quilted-speech that is represented in this article.

Or, consider how the author uses intentionally unisex names for the participants in the study. This indicates one potential characteristic of the feminine-quilted-speech: namely, that if we are to be engaged in “gender and mathematics” research, then we shall have to stop researching gender qua gender, but that, that we shall have to focus on gender qua symptom, including its symptomatic reading that the quilted-speech of our research affords or restricts. In addition, the author’s explicit call for the reader to consider how the analysis presented in the study is itself flawed or restrictive, potentially missing the mark. I see this as an example of how an intentional “shift” towards “another” quilted-speech may hold potential for mathematics education research.

The author doubles-down on this, by explicitly implicating herself in her own text, avowing that “there is no ‘view from nowhere’” (p. 414); this indicates the author’s acknowledgement of her universality—namely, that she implicates herself in her own analysis. This shall be an important position for researchers to take if they wish to advance or seek the
feminine-quilted-speech. Even further, the author claims that, in reporting on her participants’ stories, that to some extent, she is telling her own (the author’s own) story in the article. But in this, the author is saying two things: that she is telling her own story (which indicates her acknowledgement of the “work of the negative” undermining her own attempt to write up her research, but also she makes the claim that she is telling the stories of the participants, which is probably not the case. Regardless, the commitments the author is making do overall affirm the psychoanalytic position regarding language as being the medium through which we misunderstand each other, and it is in avowing this barred aspect of language that we can begin to avow the feminine position of S(A); I suspect that this will be a crucial aspect of what might be a feminine-quilted-speech.

23  **Beasley & Fischer (2012) (Fifth Epoch)**

As with the last article I analyzed, this article too offers a promising glimpse as to what a feminine-quilted-speech of mathematics might entail: it studies the “effects of group performance anxiety on the attrition of women and minorities from science, math, and engineering majors” (p. 427). This is ideologically noteworthy for two reasons. On the one hand, it inherently focuses on stereotype, which explicitly problematizes the role of the Symbolic and desire (through the Che Vuoi); on the other hand, it foregrounds the role of failure (i.e., attrition). Furthermore, the grouping of “women and minorities” together indicates that the article is seriously considering the role of the phallus in installing the logic of accumulation in the university setting.

Notwithstanding these potentials, the article does employ quantitative methods, which opens the door for masculine ideological influences; however, these “indications of the phallus” are used by the author to show men are, in addition to women, also castrated by the phallus. This
is evidenced in the article's finding that, “surprisingly, white men [also leave STEM] majors” because of stereotype threat in addition to women and minorities. In terms of political psychoanalysis, this finding may serve as evidence of the role of the phallic signifier in installing and reproducing the masculine-quilted-speech, namely that the contradiction of the masculine position indicates that the phallus makes demands that are impossible to guarantee as possibly satisfiable. This “anxiety” installed by the phallus, by its very psychic nature in instituting reality, renders clear that relational aspects such as stereotype threat need to be considered “more primary” in advancing a critical agenda for gender in mathematics education than do “positive” notions such as identity, for it is the latter that maintains the potential for reifying the capitalist notion of accumulation whilst simultaneously disavowing the role of the distinctively feminine dimensions of failure and stereotype. The latter shows the role of the S(A) in the feminine enjoyment and also reveals the contradiction of castration that constitutes phantasmic masculinity and its “true” impossibility (see Lacan, 1975/1998).

24 Bench et al. (2015) (Fifth Epoch)

This is an interesting artifact because it focuses on how men can overestimate their abilities in terms of mathematical performance. From the Lacanian political psychoanalysis, this article calls attention to the ways in which men are castrated by language: they claim they “know the phallus,” that they can “sufficiently signify as the phallus has demanded,” and thus, are able to fully accede to the masculine-quilted-speech. In a way, the article seems to commit the common signifier conflation of gender and sex (i.e., merely using the term “gender” does not mean one is studying gender), however, on the other hand, it is possible that this article is actually studying gender, because while it only codes its data in terms of men and women
(ostensibly signifying sex rather than gender), it does look at the way that this “gender” is unfolding in the social order.

The specific instance of this social order I refer to is the social link between the researchers and the subjects, when the subjects report to the researchers an estimation of “the percent [of the mathematics questions on the test instrument] they had solved [correctly]” (p. 536). In this way, the article is connecting the “sex” of the participants with the “effect caused by gender” on their testimony to the researchers. While this research method makes ideological commitments to—for example—scientism and interpellationism, it also simultaneously critiques the neoliberal underpinnings of research on mathematics achievement and performance. For example, what is the “true meaning” of the quantitative results of achievement students if the subjects on whom data was collected were not intuitively aware of their actual achievement? In my reading, it reflects a breakdown of the ideologies of scientism and interpellationism because the study shows how those ostensibly “objective” research measures can do very little in terms of reflecting what the subjects actually thought or felt about themselves. This brings into question the transparency of psychological variables, by showing that there are at least two nefarious complications also at play in gathering and analyzing achievement/performance data that would, in most settings of the mathematics education field, be considered relatively neutral and transparent in terms of capturing some objective dimension of the participants’ mental life.

The first of these variables is the “Che Vuoi” blockage that occurs when people interact: the male participants in this study spoke too highly of themselves, and overestimated their performance because the phallus has demanded it—because it was the phallic injunction that, “I must be boisterous and confident in mathematics, for the sake of the phallus, and to demonstrate that I have acceded to the masculine-quilted-speech.” This means that language is inherently
miscommunicative, which is indeed one of the core tenants of psychoanalytic theory. The second of these variables is the implicit focus of failure, namely, that the “failure of the signifier,” as evidenced by the men’s overestimation, indicates an ideologically-motivated need to focus more on the aspect of failure: I not only mean “failure” in terms of the lower-than-expected outcomes for the men on the assessment instrument in this study, but also “failure” in terms of the extent to which the masculine-quilted-speech is “overcompensating” for its own inconsistency and incompleteness. Despite the phallic promise of totality that is proffered by the masculine-quilted-speech, there is no way that it can exclude the Real from itself. Indeed, Lacan has said that the fascinating aspect of the importance of mathematics is that it has indicated the presence of the Real, and furthermore, it indicates this presence of the Real in what is effectively the metalanguage par excellence, since there is no “additional” metalinguistic structure that could confer meaning onto mathematics (see Lacan, 1975/1998; Moore, 2022).

For the men who, in this study, overestimated their mathematics performance, the authors state that the overestimation “accounted for their greater intent to pursue math fields compared to women” (p. 536). This again illustrates the role of the masculine-quilted-speech in the masculine psyche: in order to “believe” that they are capable to acceding to the masculine-quilted-speech (qua the future: intent to pursue math fields), they must already believe that, in accordance with the masculine Formulas of Sexuation, they “already have the phallus” which would act as their point de capiton for future mathematics success. As with much of masculine phantasy, this belief is transcendentally operationalized through the phantasm of the objet a: for these overestimating men, their objet a is the signifiers of mathematics. On the test, they thought of themselves as being mathematically able, a socially coded signifier that is inherently masculine (see Moore,
2021); what better objet a to take than those that are purely coded in the Symbolic as a semblance of the masculine Imaginary.

25 Kaldo & Ōun (2020) (Fifth Epoch)

The characterization of the relationship of sex to mathematics education offered by this article is an excellent example of the potential which psychoanalysis promises to add to the field’s understanding about gender, despite the fact that the artifact does not employ psychoanalytic theory. While the article commits the usual conflation of gender and sex (which is in itself the result of a variety of mis/understandings about what gender even is), the authors cite several other previous studies that the first author has also written, and the synthesis the authors craft to “paint the picture” of this article’s study illustrates to a high degree the effect of Lacan’s theory of how the subject becomes embodied and becomes gendered. For example, the issue of “gender” in mathematics is, these days, more an issue of why women “opt out of mathematics more often than male students” (Kaldo & Oun, 2020, p. 595). Therefore, we can see that these authors have also detected what might be called the “effect” of the masculine-quilted-speech over time. They are chiefly concerned in how the social aspect of gender has an increasing effect over time on the female students, when it is the “male students [who mainly hold the belief that] mathematics is a male domain” (p. 595).

Consider this claim made by the article, regarding students’ abilities to organize in mathematics class. The authors note that,

This factor [organizing] is clearly female marked that means females organize learning strategies better than males. … [B]oth genders have considerably few respondents (45.2% of females and 33.3% of males) who confirmed that they make charts, diagrams
and graphics in order to have the subject matter in a structured form often or very often.

(p. 604)

Could it be that both men and women are sublimating the psychotic nature of mathematics (see Moore, 2022), and thus hesitate to see it as such and thus make charts and graphics? Females, with their better organization skills apropos of their learning strategies, could be more aware that they are S(A), meaning that they do not “trust the phallus” and instead embody their feminine injunction that the social order is inconsistent, and thus they need to “make an account of it” in their notes in order to “keep track” of what the Big Other qua social order “told them”—like a spy keeping track of the lies they have been told so they know what to say and not say.

26 Leyva (2021) (Fifth Epoch)

This article contains three notable dimensions from the standpoint of an ideology critique. First is the Mathematics Education as a White, Patriarchal Space theoretical framework; second are the conceptual framework components of within-group tensions and resilience/coping; and third is the modality of counter-story-telling. All three of these dimensions are negative, which indicates a noteworthy difference between this article and most of the others analyzed in the present study. For example, the notion of within-group tensions suggests concrete universality through the avowal of the negative aspects of identification in identity groups. Further, the notion of within-group tensions and “coping strategies for managing such within-group tensions” (Leyva, 2021, p. 117) point towards the feminine position and the S(A).

Additionally, the article claims that it “advances equity-oriented efforts beyond increasing Black women’s representation and retention [in mathematics education] by challenging the racialized-gendered culture of mathematics” (Leyva, 2021, p. 117); key to note here is that the commonly employed “goals” of equity research—namely, representation and retention—are regarded by the
author as effectively “not going far enough.” Again, this characterization of the artifact suggests that, ideologically, the author is concerned primarily with the negative aspects of Black women’s experiences. The same can be said for the use of counter-story-telling, where the counter-stories themselves are directed “against the positive grain” of typical narrative-type research efforts that report on equity concerns.

When Leyva characterizes “coping strategies” of Black women as forms of stereotype management, I see that alignment as showing the “che vuoi.” I do not see this as being particularly feminist in nature, though, because the same strategy is characteristic of male insecurity in response to the demands of the phallus. Rather, it is because of the phallus that the Black women who are the focus of Leyva’ (2021) work are “stuck” at a crossroads: which signifier to choose? Phi or S(A bar)? Or, in other words, women’s not-All position leaves them with the burden of having to “choose their adventure” whereas the men really have no choice: they accede to the MQS via the Phi because, for them, it is existential and thus is the only mode of being in a mathematical space. However, this is simply just a recapitulation of the definition of patriarchy. I wager that an additional way for this line of thinking to contribute to the “feminine complaint” concept would be to include men’s perspectives on stereotype management, although they may not be as aware of their involvement in such psychical acts. I would further wager that failure to include men’s perspectives in this conceptual dimension indicates the extent to which the author is enjoying—i.e., participating in an ideology—too.

Leyva also employs the concepts of institutional supports (such as support groups) and their role in contributing to structural disruptions. At the institutional level, we begin to see some indications of the role of concrete universality, which is probably to be expected since Hegel was a proponent of institution-level action. Specifically, by forming support groups based on an
identity, and then the group working to recognize within-group tensions (since those identity
groups are not merely “positive” in their subjective constitution), the group leaders and members
are avowing the role of the negative in the group’s constitutive identity. And, most importantly,
what is the role of these groups?—To “normalize [Black women’s] presence, increase their sense
of belonging, and foster within-group collaboration and support” (Leyva, 2021, p. 120).

My primary critique of Leyva (2021) is that ideology appears to only be considered in its
sublimated form; thus, the author does not engage fully with the notion of ideology. I did not see
any definitions of ideology in the article, despite the concept of ideology playing a prominent
role in the theoretical framing and analysis. The author does, however, reference the origin of his
use of the concept of ideology, namely, Critical Race Theory. To be clear, my concern here is that
the article posits its goal as promoting solidarity amongst Black women—solidarity towards
what? In terms of ideological critique, I see this as leaving open the potential for such
emancipatory work—which Leyva undoubtedly advances—to miss the material basis that would
indicate a “successful” realization of concrete universality. Instead, this theoretical omission may
inadvertently lead to more MQS accession for the Black women who are the focus of his
analyses. Notwithstanding this critique, I do agree that the notion of solidarity—as Leyva
employs bell hooks’s (1984/2000) definition—is crucial in realizing the potential of the FQS as a
research tool.

27 Solomon et al. (2016) (Fifth Epoch)

This article is, together with Leyva (2021), an example of a notably different approach to
the issue at hand. While the article’s stated goal is “with the connection between individual
identity in doing mathematics and the social structuring discourses of gender and participation”
(Solomon et al., 2016, p. 56), the identities in question are what the authors call hybridized,
indicating that singularly signified identities are insufficient. This can be seen as comporting with concrete universality by avowing the role of the negative in one’s attempt to assume identity signifiers for themselves—namely, that the work of the negative is always thwarting one’s attempts to form a signifiable identity. Instead, the article focuses on how one mathematician, in contrast to identifying as “a woman,” instead developed an identity where she espoused that she “[could] actually be very feminine [in this mathematics department]” (Solomon et al., 2016, p. 55, emphasis added). “Being very feminine” suggests that the participant in the research study, and the authors, were searching for (and potentially finding) a feminine way of performing the quilted-speech of mathematics. The authors’ conceptualization of “being feminine” in this article extends their previous work on the interviewee’s (the same interviewee from both studies) description of contradictions imposed on her feminist aspirations by what the authors call the “’authoritative discourse’ of the ‘male brain’” (Solomon et al., 2016, p. 60).

The authors discuss the interviewee’s work on taking up mathematics “against the odds,” which the authors describe as an ongoing process of re-writing herself into new imagined worlds. This indicates the FQS because there is no final goal, no final signifier; there is only becoming oneself through an endless process. Further, it’s noteworthy that they frame this process of becoming as one of imagined words. If taken as referring to the Imaginary, this indicates an approach that is not concerned with the symptomatic nature of mathematics. Simultaneously, apropos of gender, this “imagined” perspective avows the sinthomatic nature of gender as a social dimension fundamentally concerned with representation (and, thus, vorstellungen). So, the approach of this article seems to avow (1) concrete universality, (2) the work of the negative in identity, and (3) the psychically “correct” way of conceiving gender.
In terms of ideology critique, it is—finally—noteworthy that the authors avow the theoretical primacy of these inherent contradictions of femininity in mathematical spaces as being the point of the research: the authors do not herald an “attempt to change [the field] towards a “feminised mathematics” or a “mathematised (masculinised) woman” but, rather, [herald a] recognition of and reflection on such contradictions” (Solomon et al., 2016, pp. 69–70). There are two points about this concluding remark that warrant critique apropos of the present study: first, the authors do avow contradiction, which suggests that “success” and “failure” in becoming a feminine mathematician operate in a dialectic, thus, further, avowing the importance of considering failure in the interviewee’s continual process of imagining her place in the department. And second, the authors state that they are not seeking to advance a feminized mathematics: there is caution and potential here, namely the caution that it may be that the authors are not pushing far enough to theorize a FQS in order to maintain some semblance of a neoliberal scapegoat (that those who seek to become feminine can still achieve in the masculine way). But, in terms of potential on the other hand, this may be the true psychical insight into these authors’ work, because the notion of a feminine-quilted-speech of mathematics is inherently contradictory and may not exist in a positive sense. In other words, it may be that the authors are not going far enough, but it may also be that they have correctly identified the psychical constitution of the FQS: that of contradiction, that of the truly feminine not-All.

28 Synthesizing the Ideology Critiques

In this section I conclude the current chapter by synthesizing the results of the preceding ideology critiques. There appears to be a high level of alignment between the overall ideological influences of each epoch and the respective artifacts from each epoch.
The individual artifacts critiqued in this chapter overall align with the political climates of their respective epochs, thus, what can be gleaned from the critiques of the individual artifacts? Over the progression of the field, gender research has evolved in several ways. First, in the first epoch, research privileged a biological perspective on gender, which is equivalent to sex. Concurrent with this came a rejection of the same argument, with the beginnings of feminist-influenced attempts to show the fallibility of biological arguments. These rejections mainly argued that women should be taken more seriously than just as a biological group, and that there were serious social factors that were the reason for the “gender issue” in mathematics education. These social factors, while complicating the legitimacy of the biological arguments, still implicitly retained the masculine position as the referent—that is, they retained the position that what the men were doing was acceptable and that women needed to be given a chance to prove themselves. This shows that through the first 2-3 epochs, the masculine-quilted-speech was not being called into question. Dimensions such as achievement and signifiable readings of women’s experience were still commonplace. Neoliberalism, scientism, and evolutionism were in full swing during the field’s infancy and adolescence.

The appearance of Solar's (1995) work signaled a sea change in the future of the field, bringing in explicitly feminist and critical perspectives to the issue of gender and mathematics. Notwithstanding this significant contribution, Solar fell short of avowing a possible basis of a feminine-quilted-speech by taking a reconciliatory approach to the feminine complaint—although she did not say it, a masculine-quilted-speech that included feminism was still possible. Given the continued evolution of the characteristics of the Epochs since 1995, to what extent has the field “advanced past” this first step, and to what extent has the field settled on this “first step” as the “end?” Looking to the characteristics of the Fifth Epoch, I think both are evidenced: on the
one hand, ideological influences of the Third Epoch are still evident and on the other hand, glimpses of the “next step” are also visible, such as in the work of Leyva (e.g., 2021). Moreover, the existence of “Third Epoch” work temporally in the Fifth Epoch (e.g., Kloosterman et al., 2010) indicates that the ideological tendencies of the Third Epoch were being advanced by some researchers despite other work in the field that was moving past it.

This “split” between those seeking new approaches and those dedicated to revitalizing older approaches became a characteristic of the field’s research, installing an ideological bifurcation between the “old” dimensions such as achievement and psychology, and those wishing to pursue critical and sociological avenues. It could be said that an apologetics appeared for dimensions such as achievement, attempting to show that neoliberalism was itself imbued with inconsistencies. This is, as with Solar’s work, an admirable endeavor—regardless, studies on large-scale data sets continued to maintain their position as somehow analyzable in specific ways to show that assessment was itself imbued with gendered factors and that achievement was still possible for women. The former is an exercise in solutionism; both are exercises in evolutionism.

The critical and feminist influences beginning in the third epoch, serving as overarching skepticism of the interpellationistic and scientistic commitments of the first two epochs, have also led to the expansion of postmodernist influence. Postmodernism can be seen as a rejection of master-signifiers, and so there has been some possibility that it could have shifted the field away from the interpellationism and scientism. However, because of the masculine-quilted-speech and the role of research production in the academy, the potential emancipation from the masculine-quilted-speech offered by postmodernism has continuously been readjusted to the capitalist logic of the school credit system, so that researchers can utilize it to breathe new life
into the avowal of the potentiality of women. This readjustment of logic back to capitalism has led to the complication of how concepts such as achievement and success are being defined by researchers, yet still maintaining the masculine position as its referent. An example of this is the influence of solutionism, itself underpinned by evolutionism, in research that posits how achievement studies can exhibit benevolence towards women, if only the correct data is analyzed in the correct way. Deadlocks have appeared, and research on gender in mathematics education continues to be an active focus, with new types of research questions appearing, such as with the case of active learning and more feminist critique (particularly Black feminist critique). This is perhaps to be expected, because in all of this process, as detected in the present study, there is still a master-signifier: the capital accumulation of the school credit system.

Finally, in the last several years of the fifth epoch, these deadlocks have begun to be approached by a small handful of researchers that instead have taken up dimensions of the negative and concrete universality, throwing doubt and complexity onto the notion of identity-based gender research. Will this trend continue? In the fifth epoch, it seems possible but perhaps not likely, as only in the past few years have studies appeared that are taking seriously the role of ideology. Thus, it remains an open question how researchers’ ideological influences will continue to unfold and shape the future of gender research in the field. In Chapter V, I take this overall synthesis of the present study’s results and offer a concluding argument for how researchers can take the present historical moment and continue to move away from the masculine-quilted-speech.

In Lacanian theory, speech and discourse (viz. Lacanian discourse, not Foucauldian discourse) are posited as a continuity. Thus far in the present study, I have developed the theories of the masculine-quilted-speech and the feminine-quilted-speech. The University Discourse
schema I introduce here is an extension of the MQS. What “social link” (i.e., discourse in the Lacanian sense) arrangement is installed by the MQS’s influence in gender research in mathematics education? It is the social link I describe by the following schema. I take as my starting point the assumption that University Discourse (Lacan, 1991/2007b) is the discursive arrangement through which research of any kind occurs. The University Discourse of gender research in mathematics education takes:

1. knowledge as master (the battery of all possible signifiers used to write about gender in published research),
2. truth as some master-signifier (phallus: quilts speech in which gender is signifiable),
3. objet a as slave\(^{69}\) (research artifacts such as those analyzed in the present study), and
4. the split-subject/alienated position as the product (researchers and their research subjects: we have not gained wisdom over the five epochs).

In the context of gender research in mathematics education, knowledge supported by truth means that the psyche takes “mathematics as an object” through the identity-quilted-speech signification of M20 institutional mathematics (Baldino & Cabral, 2018). Published research objects supported by alienation follow the same structure as the pervert’s phantasy; further, because of this, mathematics is sexual in the psyche (I discuss this more at the end of Chapter V).

From this discursive arrangement, alienated subjects are what are produced by gender research in mathematics education. This alienated subject-position is masculine (Lacan, 1975/1998); hence,

\(^{69}\) The “slave” position in Lacan’s Four Discourses (Lacan, 1991/2007b), and can also be referred to as the “work demand” position. The “slave” nomenclature comes from the fact that Lacan theorized the Four Discourses drawing on Hegel’s (1807/1977) master-slave dialectic. The important aspect of this dialectic in the Four Discourses should be considered as a dialectical pole to the “master” position: it is the master who makes demands, and the slave who carries them out. In my usage of the University Discourse here, it is the artifacts that bear the weight of the work burden, because it is the artifacts, such as research articles, that “know” in place of the master’s knowing. In fact, it is the artifacts that “know” what they are, although this is a “knowing” that is unknowable to us as humans, because the artifacts are nothing more than paper with symbols on them; we, as researchers, “assume” a priori that the artifacts “know what they are saying” in their words/signifiers.
the identity-quilted-speech of mathematics education research is also masculine, which is what I have in the present study termed the masculine-quilted-speech.

Research on gender is thus constituted by this masculine-quilted-speech, and knowledge of gender in mathematics education is the product. Since the alienated knowledge/non-knowledge is the product of this process, research on gender in mathematics education only produces masculine knowledge, knowledge that is “known.” However, this is the mark of the original male forgery (Lacan, 1967/n.d.-b), and it is through the (masculine) enjoyment of this process, in which all researchers engage and enjoy, that the enjoyment of interpellationism becomes one of the primary ideologies underpinning gender research in the field of mathematics education. Then, being enabled by interpellationism, scientism has retained its tenability, and even reclaimed some of its lost tenability in the face of critical and feminist trends away from biological scientism in the Third, Fourth, and Fifth Epochs.
CHAPTER V

CONCLUSION
V  Conclusion

1  Primary Critique of the Ideological Artifacts

As I have shown in the present study, almost all of the 25 analyzed artifacts—which were taken to represent the most influential corpus of research articles on gender in mathematics education—retroactively reify the Symbolic masculine-quilted-speech of mathematics, the ideological residue of which remains as the only valid answer to the question which undergirds the pursuit of gender equity in mathematics education. This results, overall, in a disavowal of the Real of the mathematical discourse in school, and thus—by foreclosing the possibility of an ‘other’ jouissance that signifies nothing—also results in a hatred of knowledge of jouissance. Since knowledge of jouissance is wisdom (Lacan, 2011/2018), this hatred of knowledge of jouissance leads me to my primary conclusion of this study: namely, in light of the findings of this study, that gender equity research in mathematics education does not achieve its intended goal of more gender equity, but rather, because of the effects of the signifier in the unconscious, leads to more gender exclusion; consequently, non-cis-males experience the masculine-quilted-speech through the capitalist mode of school through an unconscious experience of cruel optimism (Berlant, 2011), signified as “achievement,” “attitude,” or similar by the ideologies I have identified and critiqued herein.70 My basis for this claim comes from the overall synthesis in the previous chapter, primarily evidenced in the ways in which the masculine-quilted-speech continues to exhibit a primary influence over the conceptualization and publication of gender research in the field of mathematics education. Next, I explain my rationale for this claim, noting that this finding is in line with what Baldino & Cabral (2006, 2018) have also found. However, in many ways, because of the effects of ideology on myself as the writer of the present study, I

70 This experience is illustrated by the language of the artifacts analyzed in Chapter IV.
have also committed many of the masculine-quilted-speech intrusions in this text that I have sought to critique, which is also in line with the findings of Baldino & Cabral (2018); my intended respite from this likely inevitable, self-implicating conclusion is that, by comparing the discourses in Chapters II and IV, I have attempted to invert the masculine-quilted-speech by interrogating it, opening up a possible ‘other’ discourse: or rather, a phantastic semblance of an ‘other’ discourse that might enable a return from the Symbolic back to the Real, and thus to an acknowledgement of the role of knowledge of jouissance (see Lacan, 1975/1998)—a jouissance that signifies nothing because it is Real.

In other words, a feminine-quilted-speech of mathematics would reveal the jouissance of performing gender research in mathematics education. Revelation of jouissance contributes to the feminine complaint, which is a necessary component of any feminist struggle. This feminine complaint can serve to reverse the sublimation that has occurred in most of the artifacts analyzed in the present study. Or, said another way, the efforts of gender researchers who have, perhaps inadvertently, “enjoyed” the task of gender research indicates the extent to which the researchers have made their results seem less ideological and more socially acceptable. This is what Lacan (1986/1992) called sublimation: by making ideology seem less ideological through the psychical process called sublimation, one necessarily pays for that act with enjoyment. The “less ideological” one posits one’s research as, the more they have enjoyed it. Gender researchers have indeed enjoyed performing and publishing gender research, and the results of the present study indicate that most of this enjoyment has been masculine. The feminine complaint can help recognize and undo this commitment. Next, I elaborate what the consequences of this finding might be, which I develop “in sequence” in the next three sections of the present chapter.
(Re)Avowing the Real: A Critique of the Masculine-Quilted-Speech

Following Hegel, Kojève (1947/1980) describes the essential factor that separates human-being from Nature: “the Subject opposed to the Object” (pp. 158–159, emphasis in original). Since it is the Symbolic that—for Lacan—brings forth the dimension of the Subject, a homology can be reached that it is the Symbolic that is necessary in distinguishing human-being from Nature. However, the Symbolic is necessarily concomitant with the Real; therefore, the Real can also be viewed as the necessary condition for human-being. Connecting this to the above, Kojève is elucidating that it is in the Real that the Subject comes to know theirself as Subject rather than Object; this is the castration effect of language. Under capitalism, this leads to somewhat of a paradox: that the masculine-quilted-speech, through the act of taking Mathematics as its object in order to create gender, attempts to posit a crucial dimension of human subjectivity within the Symbolic only. This is to be expected though, because capitalism is largely successful by applying continuous pressure on the Real to keep it at bay; in doing so, capitalism easily responds to the Real, morphing and evolving to each challenge that is posed to it. Recall, though, that gender is a sinthome (Gherovici, 2017), meaning that it emerges as a consequence of the Real, and then proceeds to thread together the entire psychical edifice. Thus, in revealing the extent to which the masculine-quilted-speech formats our field apropos of gender research, the critical response by gender researchers should be a re-avowal of the Real, for it is in the Real that the feminine jouissance is evident. In this section, I describe that charge.

The masculine-quilted-speech on gender in mathematics education creates the problem that it seeks to remedy, by insisting on the creation and reification of the signifier “woman” (who doesn’t exist) in order to create a masculine signifier for woman that can be quilted into the masculine speech of the field. In essence, this speech is one of an existential conundrum: how do
researchers work towards advancing the betterment of non-males’ existence in mathematics contexts? *Qua* existential, gender is one of the most fundamental parameters of becoming embodied (Gherovici, 2017). The question of existence—of any gendered body—is implicated by the realm of mathematics itself: the discourse of mathematics, according to Lacan (1975/1998), is “the first discourse to perceive that the Symbolic order itself contains elements of the Real” (Pais, 2017, p. 785). However, the masculine-quilted-speech of mathematics in the educational context, interested in only the Symbolic, disavows the Real in the interest of pursuing a totality of its academic content.\(^\text{71}\) This leaves subjects in a peculiar position with respect to the academic content of mathematics. In disavowing the Real, the masculine-quilted-speech—*qua* Symbolic—retroactively produces ideological bases for itself that are masculine. This retroactive production of ideology is one of the key reasons that, in much of the data analyzed in the present study, the same ideologies reappeared repeatedly. It is the discourse itself that leads to these unconscious ideological effects, because the unconscious is structured like a language. In other words, the discourse, in following the logic of the signifier, retroactively produces meaning to the claims made by the discourse.

There is no conscious discourse that could proceed otherwise, however. It is precisely for this reason that the discourse of mathematics is of particular importance in understanding the role of gender within the capitalist mode of school, namely, that the mathematical Real is ideologically disavowed for the sake of the promulgation of the mathematical Symbolic. Lacan claims that this relationship is the beginning of all existential questions: “[The masculine speech-function] presupposes that we spell out what existence might be… [The] notion of existence only emerged with the intrusion of the mathematical Real as such” (Lacan, 2011/2018, p. 158, 

\(^{71}\) For example, Gödel’s Incompleteness Theorem, which shows the limits of the (im)possibility of proof in the mathematical Symbolic.
emphasize in original). Lacan is saying here that the mathematical Real led to the emergence of existential questions which in turn led to the emergence and dominance of the masculine-quilted-speech of mathematics. If we are to be engaged in gender research in mathematics education, we must re-avow the Real and its role in the existential questions that gender research attempts to solve. By investigating the symptom as such, the role of the mathematical Real in creating the issue of “gender and mathematics” in the educational context can be re-avowed.

3 Gender, Mathematics, Capitalist Schooling: Towards a Feminine-Quilted-Speech

With few exceptions to this inevitable paradox (which is itself evidence of “the conflictual character of moral experience”; see Lacan, 1986/1992, p. 3), the literature I analyze in the present study commits ideological devotion to the exclusionary failure that is necessary to support the capitalist mode of school; implicated in this avowal of the necessity of failure is also the capitalist imposition of the creation of the category of “woman.” In other words, gender functions as an active agent at the heart of capitalist economy in school mathematics.

The burden of women in mathematics to perform as masculine in order to succeed is a symptom of the capitalist mode of school—viz. that students must perform a certain way and achieve certain things, as determined by assessment, graduation, and social acceptance pre-conditions—in order to be granted access into the economic structure of society. Whether women “succeed” in school or not, the imperative of gender mediates their social, economic, and educational futurities. In developing the argument in this section, I use Spivak’s (1988) post-colonialist subaltern to theorize how the ideology of gender operates in governing performative burden on women to seek success in mathematics by asking the question “Can women in

---

72 Here, Lacan is asking whether or not there exists an x that would satisfy the function.
73 I would like to thank Dr. Bonnie Zare for providing helpful feedback and encouragement to develop this line of thinking.
mathematics speak for themselves?” Additionally, I employ Berlant (2011) to theorize how mathematics—in light of the preceding—is an agent of cruel optimism for women. The main thesis I shall develop here is a rejection of the notion of gender as divorced from economy, in that gender is itself an agent of capitalist accumulation. This occurs because capitalism requires the creation of the category of “woman” in order to foreclose woman. Women can either perform as men and achieve success in mathematics (viz. capitalist accumulation via the school credit system), or they can do the opposite and enter a social role like the subaltern (e.g., the housewife who never graduated), again reifying the capitalist system. For this reason, the mathematics psychosis is particularly effective in structuring both economic and gendered relations because it operates along the lines of sentimentalism (Schuller, 2018) in late capitalism, relying on the impressibility of the body qua the extent to which subjects can adopt a psychotic position for themselves—a process that fundamentally involves a commodification of bodies.

Gender functions as a sinthome in that it allows a subject to represent themselves in a way that they want to be recognized by others. Facial recognition is one of the first determinations that one makes when seeing another person, leading gender to have a particularly important role in representing oneself. Following from my previous elucidation about the connection of gender and economy, we can deduce that economy structures one of the most important sinthomes in which we engage: viz. gender. The same analysis applies to mathematics because of its power as a social signifier: it is assessed along lines of the production and qualification of labor-power produced by students and teachers (Baldino & Cabral, 2013, 2015;

---

74 Woman is the precise non-phallic way of signifying woman, that is, without a signifier. In modern feminist discourse, we have come to know the term “womxn,” which is essentially equivalent to Lacan’s proposed woman from his seminar of 1972-1973. I describe this more in the next section. Thus, what Lacan proposed in 1972 was arguably the precise feminist position.
A LACANIAN IDEOLOGY CRITIQUE OF GENDER IN MATH ED

Cabral & Baldino, 2019). It is my claim that this gridlock results in mathematics being designated as a doubly-cruel object.

Because gender in mathematics operates in the mechanism of the reflex-category (Moore & Johnson, 2021; under revision), performances across the border between the masculine and feminine are possible, but only in one direction: the woman must perform as masculine, but the men are not required to perform as feminine. My claim for that one-way relationship was developed through the Hegelian-Marxian dialectic of the lord and bondsman. Why would women engage in this lopsided relationship? Because they must do so in order to be successful in the late capitalist schooling system. Mathematics delineates all of academic life, and functions as a sorting mechanism for bodies in schools (Moore, 2022). Women are obligated to engage in this because of the function of sentimentalism apropos the Big Other, which is mathematics in late capitalism. Because capitalism has installed mathematics as the Big Other, students must engage in the process of the production of qualified-labor-power (Baldino & Cabral, 2013, 2015) in mathematics in school.

Additionally, the burden of this qualification of labor occurs in a particularly cruel way for the women: that they must perform as male in order for their mathematical labor to be properly qualified. Crucially, this qualified-labor-power is only qualified if it is masculine. This is quite simply the reason for the gender fetish in mathematics education, constantly obsessed with helping the women perform at the same level as the men in order to be “successful.” In addition, women must perform their feminine role (viz. Lacan’s “the other’s jouissance”) in order to be qualified as good, respectable citizens of the classroom. Since success in mathematics is the key mediator of high school graduation, this becomes a performative imperative on women. Thus, capitalism makes women’s success in mathematics contingent on a foreclosure of woman,
instead insisting on a category of “woman” as a signifier, which requires Symbolization, and is thus phallic. By performing masculine qualified-labor-power, capitalism creates “woman” as a signifier and category. There is no “woman,” only woman. Thus, if we take woman’s necessity of self-realization (as indicated by the position of the bondsman in the reflex-category dialectic; Hegel, 1807/1977) as an imperative, then woman’s relationship with mathematics is one of cruel optimism, because it is actually a relationship between “woman” and mathematics. For “woman” in the capitalist mode of school, mathematics is a cruel object because it forecloses the possibility of quilting herself into the speech as woman. Women in mathematics “cannot speak” because the only legitimate quilted-speech is that of the masculine position. Further, this again implicates the school as a site of capitalist production: if the women are oriented towards adapting the masculine position for themselves (to be able to speak) then gender reveals itself as operating at the very heart of capitalist production. The category of “woman” thus becomes homologous to Spivak’s (1988) subaltern—what in Spivakian terms would be, “Subalterns cannot speak”: in both cases, they cannot represent themselves.

Acting as an agent of capitalist accumulation, Mathematics serves as a sorting technology for bodies, and, in this capacity, it discriminates bodies along lines of gender, race, and class. Within the discrimination of gender, another layer of interaction occurs between gender and class, namely that the ideology of Mathematics forecloses the non-signifier woman in favor of a creation of a phallic, Symbolic category of “woman” to which the non-cis-males to must ascend if they are to produce qualified-labor-power in mathematics in school. Or, said in reverse, the phallic determination of qualified-labor-power in Mathematics forecloses woman. The school credit system—qua the meritocratic fetish of mathematics success—only functions successfully if some students fail: the value of those who fail is seized as surplus-value by the ones who
succeed *qua* pass (Baldino & Cabral, 2006, 2013, 2015; Cabral & Baldino, 2019; Pais, 2014, 2015, 2016). Crucially, successes are only qualified *as successful* if they are coded as masculine. As a result, mathematics is a doubly-cruel object for “women,” an object with which they are required to engage through a relationship of cruel optimism (Berlant, 2011).

In short, because mathematics posits to operate at the level of universality, it must necessarily contain an exclusionary negative element that forecloses the Imaginaries of students. Because mathematics itself is Lacking, it cannot tell us what it wants: this Lacking nature, the Real of mathematics, is not codified by the capitalist mode of school—rather, only the Symbolic of mathematics is. Subjects engaged in the mathematics education enterprise, because of the effects of ideology, execute acts which support this necessary exclusion: by not reflecting on the Symbolic, many researchers necessarily create a “toxic Symbolic” that forecloses others’ Imaginaries, because the Lack in the Imaginary does not self-represent to us (Lacan, 1986/1992).

The masculine-quilted-speech, *qua* Symbolic, is the hidden referent position in most of the field’s research on gender and mathematics, thus creating a “toxic Symbolic” with which women must engage in order to quilt themselves into the speech. If this quilting is performed, then these women have “become successful” precisely when they “become men.” This indicates a significant, yet predictable, contradiction in the pursuit of “equity” research amidst an inherently inequitable system of political economy—viz. capitalism and its associated mode of school. The masculine-quilted-speech, itself a product of capitalist political economy, takes Mathematics as its object; in turn, Mathematics creates gender in its perverse, categorical, signified form. If the masculine-quilted-speech had not become the dominant speech of the capitalist mode of mathematics education, then perhaps the primacy of sexual difference would be avowed in our current moment, rather than the primacy of gender.
In short, there is no “gender ideology”; it is sexual difference that has been “ideologized”—through the mechanism of the masculine-quilted-speech—the result of which is the misrecognition of gender as an identity rather than a sinthome. Maintaining the concept of gender as an identity allows for class struggle to be sidelined in favor of cultural wars over a psychically inexistent concept; however, this is the game that capitalism plays because capitalism is successful by keeping the working class distracted away from class struggle, and the masculine-quilted-speech of mathematics has played a foundational role in the creation of this “misrecognized” version of gender.

4 Failure, the Real, and Universality: The Foundation of the Feminine-Quilted-Speech

In this section, and in order to begin to operationalize the findings of the present study, I outline possible foundations for a feminine-quilted-speech; by foundations, I mean what might serve as points-de-capiton that expressly interrogate the master-signifiers from which the masculine-quilted-speech proceeds. In what precedes this section, the FQS is not expressly evident, and that is also a defining quality of it, because a feminine-quilted-speech would necessarily contain quilting points that consist of “that which cannot be said about itself.”

Notwithstanding researchers’ intentions to promote gender equity in mathematics education,

[A] politics directed at gender, race, or any other identity is a game lost in advance. The struggle for identity is a perfect substitute for the class struggle, since it keeps people in permanent mutual conflict, while the elite withdraws and observes the game from a safe distance. (Birnbaum, 2012, as cited in Žižek, 2018, p. 128)

Class struggle works at the level of universality, since economy is a master-signifier. Thus, the Marxist feminist approach would be that class struggle overdetermines gender struggle
(and any other struggle based on identity politics). In short, this is why the data analyzed in the present study does not lead to more gender equity, but rather to more exclusion (see also Baldino & Cabral, 2006). This is the effect of ideology in the unconscious. Just as class struggle aims at abolishing class difference, these proxy struggles (such as gender politics) overlook the primacy of difference itself. Gender struggle is a powerful proxy for class struggle because gender, as I have shown in the present study, is a product of the instability of sexual difference. Since sexual difference is primary in the development of the subject, its sublimation is always-already accomplished by the time the child knows what gender is: they think their gender is something they have always had, because it was Symbolically pre-assigned to them by their parents and society at large. The transgender experience is an example ripe for analysis: what is the goal of the argument that goes along the lines of “being born into the wrong body?” Such an argument does not comport with the psychoanalytic perspective because it conflates ethical and psychical arguments. Gender, as I have shown, works in a different way apropos of the psyche: it is a process of becoming.

This means that there is no a priori gender of a person, which consequently opens up a queer, transgressive potential for the future of gender. This radicality of gender’s emancipatory potential, then, must be liberated by researchers: By focusing on access to concrete universality rather than identity, gender can be conceived as a process of becoming-embodied. Indeed, this is why one must declare (not determine) their gender in the Symbolic, because it is only through the act of declaring one’s gender that one is able to articulate desire. The bound of desire is the body, so without declaring one’s gender, there is no way to know what the bounds of desire are. This is perhaps the key exploitation of capitalism on the impressibility of human Subjects: by promising to clearly and Symbolically delineate the “rules of desire,” capitalism tricks humanity
into thinking that the Symbolic is consistent and complete, and thus capitalism posits desire as readable. The crucial insight here is capitalism’s forgery apropos of gender: capitalism, being itself written in the language of the masculine-quilted-speech, posits the masculine-quilted-speech as the only valid language through which desire (and thus gender) can be read. This is a capitalist forgery because even in mathematics, in the mere fact that mathematics is a language that indicates the undeniable presence of the Real (Lacan, 1975/1998), the feminine-quilted-speech is found in mathematical failure (see Copjec, 1994/2015): both in the failure of the capitalist reading of gender and in the failure of the capitalist reading of desire. The distinctively masculine forgery of capitalism, executed through the masculine-quilted-speech, can be glimpsed thus: the category of “woman” is posited by the masculine-quilted-speech as normative and Symbolic. This cannot be, because the feminine enjoyment, being excluded from the Symbolic, thankfully gives a hopeful view “out of” the trap of the masculine-quilted-speech: the category of “woman” can be refused, and it is within this distinctively feminine refusal of “woman” that the concept of gender can be reclaimed from the masculine overdetermination that has been imposed on it through capitalism. It is only through a radical re-avowal of the Real—of the radical admission that even in the midst of capitalism and its masculine-quilted-speech—that there is still a desire of the Other: without this distinctively feminine “escape route,” there might not be an alternative to the mathematically formatted fate that the present moment has inherited from the masculine-quilted-speech.

The masculine-quilted-speech of mathematics, acting as capitalism’s “formatting agent” in the era of Solutionism, promises a “readable” interpellation of gender. This Symbolic injunction operates in the same way as much of capitalism’s imperatives: to stabilize precarity, to install a belief that the Real is readable and thus understandable through knowledge. This
“objectification” of the Real forecloses concrete universality through the use of proxies. This is, in short, why the Fifth Epoch has issued forth the most promising glimpses of a feminine-quilted-speech and the most symptomatic rejection of it at the same time.

In light of the events of the Fifth Epoch, the radical task now—at the present moment—is advancing access to concrete universality. I draw on Hegel’s revelation of the impossibility of identity politics here:

[Hegel’s] ‘[c]oncrete universality’ means that there is no abstract universality of rules, there are no ‘typical’ situations, all we are dealing with is exceptions; however, a concrete totality is the totality that regulates the concrete context of exceptions. […] To the nominalist claim that there is no pure neutral universality, that every universality is caught up in the conflict of particular ways of life, one should reply: ‘No, today it’s the particular ways of life that do not exist as autonomous modes of historical existence, the only actual reality is that of the universal capitalist system.’ This is why, in contrast to identity politics, which focuses on how each (ethnic, religious, sexual) group should be able fully to assert its particular identity, the much more difficult and radical task is to enable each group to access full universality. […] This means recognizing one’s own universality, the way it is at work in the fractures of one’s particular identity, as the ‘work of the negative’ that undermines every such identity. (Žižek, 2018, p. 65, my emphasis)

In short, this is why gender equity research in mathematics education—when conceived of as a game of identity politics rather than as a proxy for class struggle within the school credit system of success/failure—will never lead to more gender equity but only to more exclusion. This “exclusion” is to be interpreted literally: the continued writ broad avowal of the masculine-quilted-speech will lead to more “non-males becoming men,” endorsed by the results of research
on gender, which is precisely homologous to “more success in mathematics”—and with more success will concomitantly come more failure, and thus more exclusion. My use of the term “exclusion” thus—precisely—means exclusion from the masculine-quilted-speech. We succumb to this paradoxical trap because scientific speech nonetheless returns to the level of considering “the symptom in facts” (Lacan, 2013, p. 333, emphasis added). In other words, qua symptom, gender is precisely excluded from scientific speech. The data analyzed in the present study affirms this claim. The analysis presented in the present study, however, is itself a symptom of the analyzed artifacts. The ideologies of the preceding research analyzed herein create a need for a pause: have my actions in the present study already been delineated for me beforehand? Am I simply carrying out those actions which ideology has already set before me?

The level of political economy—that is, explicitly avowing the role of gender as an agent of the capitalist mode of school—is potentially the only gap wherein we can “trick” ideology into giving us a different future. Will this shift also yield actions that have already been delineated for us beforehand? Is there a way out of this trap? If there is, I follow Pais (2012) and wager that it shall only be possible at the level of political economy, at the level of allowing access to sinthomatic concrete universality in school and in mathematics education research itself—and not at the level of identity politics. The takeaway point here is that, since Mathematics and gender are both symptoms, advancing research at the level of the Real—and thus at the level of the feminine-quilted-speech—is a promising avenue through which concrete universality for our research Subjects might be granted.

There are two key threads of research that have appeared recently (in the last 10 years) that indicate the potential inclusion of concrete universality in the pursuit of a feminine-quilted-speech. Namely, I am speaking of the work of Leyva and colleagues (e.g., Leyva, 2021) and
Solomon and colleagues (2016), which are the final two artifacts I analyzed in the present study. To illustrate this, consider the dimensions that these two articles engage with: (1) becoming, and (2) the role of identity in political economy. For example, Solomon and colleagues (2016) indicate the role of gender as a process of becoming, functioning through hybridity of identities as the participant navigates the patriarchal space of a mathematics department. By avowing the role of gender as a becoming process, these authors show the potential for studying gender in mathematics education as a *sinthomatic* way of “making life livable” (see Gherovici, 2017). Similarly, in the work of Levya (2021), the role of marginalization is discussed and theorized using distinctly “negative” dimensions such as counter-stories, resilience, and tensions created by patriarchy. I contend that it is an explicit focus on the “negative” aspects of gender such as this that will be integral to conceiving of a feminine-quilted-speech. Both of these articles are notable in their language use: they focus on precarity, becoming, incompleteness, and struggle. These reflect the important role of conceptualizing and advancing concrete universality in future work on gender and mathematics education, and further, I claim that they should replace research foci such as achievement, success, and other “positive” dimensions that are afforded by psychological theories, such as confidence. However, on the level of ideology critique, research in this vein should be vigilantly aware of the potential that continues to exist for “adjusting” the contributions of these “negative” dimensions back into a role that supports the “positive” advancement of the masculine and accumulative logic that underpins and indeed enables the capitalist mode of mathematics education research. In short, researchers who advance “the work of the negative” should be commended for their efforts, but they should also be continuously suspicious of the effect of ideology in imbibing their critical work with the capitalist demands of the masculine-quilted-speech.
To summarize my findings in the present study as to what exactly might be a feminine-quilted-speech, I have shown how there are several philosophical tenets that must be avowed in the purpose, motivation, and execution of research on gender in mathematics education. These tenets consist of:

(1) *Concrete Universality and the Negative:* When conceptualizing a study or theoretical exposition, there must be an explicit avowal and implementation of the philosophical dimension of the negative, including but not limited to the notions of contradiction, incompleteness, and failures in the process of becoming. This includes explicating in the published research the “work of the negative” imbuing the authorship team’s members, the research question, and—most importantly—the purpose of the research itself. Published research on gender in mathematics education should put contradiction and negativity front and center in its rhetorical form. Ascertaining “positive takeaways” or “useful implications” should be viewed with suspicion and thus not included; speculation and incompleteness (of and in the published research itself) should replace them. In short, there should be no semblances of answers; instead, researchers should consider the “negative” of their own gender in undermining any attempt to employ theorizations of gender and/or interpellate their study participants’ gender (see Žižek, 2018).

(2) *Failure:* Extrapolating from the work of the negative, there must be an explicit avowal of the primacy of failure. Research must be focused on failure, as the goal of the research itself. Note here that I do not attempt to reconcile the role of failure contra success. The notion of success is at issue here: a FQS should avow that the focus/motivation/purpose of research is the failure itself—not seeking to “treat” the
failure in order to promote more success (see Copjec, 1994/2015). In other words, it is not failure to be remedied; it is failure—as a symptom of the capitalist mode of school—full stop. This means that the notions of achievement, success, and similar concepts should be eschewed in gender research in mathematics education, because these concepts retain the MQS as their referent.

(3) The Real: Following from failure, the mathematical Real must take a prominent role in research on gender in mathematics education. The relationship of the Real to the Symbolic is foundational in psychoanalysis, and mathematics is a unique language in that its Symbolic constitution always-already includes—and even reveals—the Real. For example, the symbols that are used to represent mathematical ideas are themselves perplexing, in that there is no metalanguage to make them consistent: one must always be engaged in explaining what the symbols mean and what one is going to do with them. Mathematics is thus unique in that the Real plays as much of a key role as does the Symbolic. Much mathematics education research foregoes engagement with the Real, via sublimation, rendering mathematics as merely Symbolic. The mathematical Real means engaging directly with the “perplexity” concerning the signifier. Research on gender in mathematics education should avow this perplexity and the role of the Real in teachers’ and students’ thinking about (Symbolic) mathematical concepts and acts. In doing so, researchers should take up a position that mathematics is perplexing and focus on those parts of mathematics that resist Symbolization, rather than avowing a position on mathematics that aligns only with curricula, community norms of understanding and argumentation, and standardized formats. By focusing on the Real, research on gender in mathematics
education may be able to push past the symptomatic confines of the Symbolic that overdetermine conceptions of what mathematics is and is not (see Lacan, 1967/n.d.-b).

5 Implications for Mathematics Education

In light of the preceding possible foundations of a feminine-quilted-speech, I suggest in this section some implications that this study has for the field of mathematics education. However, in doing so, I allow the masculine-quilted-speech to irrupt back into the present study, indicating that I too am not immune from its effects as a researcher and member of the mathematics education community. Notwithstanding this, I make the following suggestions for how the results of this study can be implemented in the field:

(1) Assessment: At the classroom/coursework level, there must be alternative ways of assessment, such as the “un-grading” trend where students self-assess their effort and the teacher does not impose grades for assignments. In effect, this is a feminist complaint against the school credit system. This is in line with the findings of Baldino & Cabral (2021). At the institutional level, do away with all standardized measures of assessment, replacing them with a holistic integrated rubric to assess effort for solving a problem faced by the world that brings students together in collaboration. In this arrangement, “success” means contributing to the elimination of class divide and all of its symptoms, such as environmental justice, racial justice, and gender justice. From the intersectional feminist approach advanced by Leyva (e.g., 2021) and the Marxist feminist approach I advance in the present study, these concepts are all connected. While this may seem to be too “open” of an approach to ensure “success,” the traditional notion of success must be eschewed, in favor of a mindset in the
teaching/learning encounter that avows the anxieties, failures, and contingencies of both the students and the teacher. The teacher must be willing to “sit” right in the middle of the “mess” with their students. If traditional assessment must remain due to institutional constraints, then the teacher must be transparent about the role of the assessments contra to the role of the actual learning; this shall address the psychical divide between the “I want to learn” and the “I want to pass” (see Baldino & Cabral, 1998, 1999). Success means something different, personal, and intimate to each person involved in the pedagogical encounter. Success does not mean successfully treating some deficiency in learning outcome. Success means assisting subjects in the mathematics education arena with confronting their symptoms regarding mathematics education; success means the successful traversal of phantasies. Teachers, students, and researchers must all participate in this shift in focus. The same mindset must be carried over into research, which I discuss in (3) directly below.

(2) Combine (1) with inquiry-based learning or inquiry-oriented instruction: Because of the extraneous burden leveled on non-cis-males in active learning classrooms (e.g., Johnson et al., 2020; Moore & Johnson, 2021), alternative assessment can work to alleviate this lopsided burden whilst retaining most of the benefits of active learning.

(3) Reconceptualize research: Gender research should be coauthored by one researcher and one research participant, where the final product is conceived of as a conversation without an end goal in mind and without a privileging of “usefulness” or “takeaways” in the “results” of the research. Leave research studies “open,” and the ends of studies imbued with questions and uncertainty. This means taking a very different view on the linguistic norms of research. For example, in the case of Leyva (2021) and
Solomon et al. (2016), the use of methods such as counter-story-telling and conceptualizing the research subject as engaged in a process of becoming-embodied, leave the reader of such artifacts with more complicated feelings and understandings than they likely would have had at the beginning of reading the artifact. Further, this means that there should be no gender research published utilizing quantitative data or methods; this is in line with the findings of Forgasz (2021).

(4) Abolishing hierarchy means abolishing interpellationism: There should be no hierarchy in the classroom or university. This can support arresting the underlying trend of interpellation in academic research. Researchers must acknowledge that they do not know themselves; thus, they have no way of “reading” their subjects. Teachers must acknowledge the same; thus, they have no way of “reading” their students. This is a known finding of academic research in the critical feminist and queer studies fields. For example, in concert with (1) and (2), this may include teachers and students signing “learning contracts” or similar documents that establish an equal class structure between students and teachers. Teachers should, in this arrangement, assume that all students will be successful in the class and personally take responsibility for ensuring this happens. The goal is not to abolish gender, because that would be impossible; there will always be sexual difference. The goal, rather, is to use the class-less classroom as a way of advancing concrete universality for all students, as well as assisting the teacher in remembering that they too are imbued with negative inconsistencies in their own gender and identities. In other words, while gender will always remain a crucial part of self-representation and necessary for the articulation of desire (see Lacan, 1967/n.d.-b), gender must be conceived of by
researchers as “unreadable”; or, said another way, if we wish to continue researching gender, we shall have to stop doing research on gender.

6 Next Steps: The Mathematical is Sexual

I conclude the present study with possible next steps for my research. As I have shown in the present study, the masculine-quilted-speech of mathematics—that I posit as the only valid speech of mathematics within the modern “M20” (see Baldino & Cabral, 2018) and capitalist mode of school—is both over-determinative of the issue of gender equity and the mathematics education enterprise itself. At the level of political economy, this realization remains an ideological commitment, and it is because of the field’s overarching disavowal of political economy as evidenced in the analyses in the present study—especially within equity research—that the psychic foundation for this remains absent. I refer here to what is precisely, in psychoanalytic theory, called substitute enjoyment. Since enjoyment is an imperative under capitalism, substitute enjoyment manifests when the “Real jouissance” is hidden.

Why and how might mathematics education researchers be hiding their jouissance? And, more specifically, which jouissance is being hidden? The discourse of science (equivalent to what Lacan called the University’s Discourse; Lacan, 1991/2007b) is necessarily masculine, because it puts knowledge in the master’s position, supported, as such, by a master-signifier such as the phallus. This knowledge, in turn, puts work demands on the objet a in order to produce unknowing subjects. This relationship—within the University Discourse—between the subject and the object has the same structure as the pervert’s phantasy (Lacan, 2004/2014). Thus, knowledge takes Mathematics—the scientific metalanguage par excellence—as its desire-object, which, in turn, produces (masculine) knowledge about gender. This is, quite simply, the
“madness” of attempting to produce knowledge about gender apropos of mathematics (see also Britzman, 2010).

At stake here is the issue of jouissance. The jouissance involved in producing knowledge about gender is precisely a knowledge of mathematics, of signification—not knowledge of jouissance itself. This mismatch—within the question of “Which jouissance?”—is the reason the field has produced, and indeed possesses, lots of knowledge about gender and mathematics, and yet there is no clearer understanding of what it purports to achieve in terms of woman. As I suggested earlier, it is only recently that the masculine-quilted-speech has begun to be interrogated, and a feminine-quilted-speech is beginning to be glimpsed. It is in the pursuit of “knowledge” (which is indeed the imperative of the University’s Discourse; Lacan, 1991/2007b) that researchers must “hide” their masculine jouissance, instead referring to it as knowledge qua master.

If I make the claim that “The mathematical is sexual,” it is relatively unoriginal: Lacan has shown that any linguistic and significatory action is itself sexual in nature, functioning through a substitute enjoyment that results from the inexistence of the sexual relationship (Lacan, 1975/1998, 2011/2018; Zupančič, 2017). Such a claim lays uncomfortable with the purism75 of modern society, as dictated by the capitalist imperative of sexual disavowal and the forced stabilization of identity (e.g., Žižek, 1989/2008a, 2020b). However, within the psychoanalytic frame, this is merely a symptom of the market because there can be no capitalist accumulation from sexuality (not reproduction). This is perhaps the reason why it is so unfathomable to conceive of what a feminine quilted speech of mathematics might be: this is the question that opened and guided the present study, so I return to it in order to conclude here. Insofar as the

---

75 This purism is, for example, illustrated by the capitalist disavowal of the Real as the dialectical source of jouissance in the Symbolic (see Lacan, 1975/1998).
M20 identity-quilted-speech of mathematics is a “discipline of the written”—a psychotic access to an “it’s written”—I end with the following insight by Lacan (2013), which levels my claim that “The mathematical is sexual” as relatively indisputable: “An ascesis of writing seems to me only capable of passing by meeting up again with an ‘it’s written’, with which the sexual relationship might be installed” (p. 334). In ‘other’ words, a feminine quilted speech of mathematics might only be possible by recognizing the function of the mathematical ‘it’s written’ within political economy: only then might an ‘other’ jouissance be found as a ‘substitute’ for the current state of ideology in mathematics education. The phallus has instituted its demands all over gender research in mathematics education; and what, precisely is the most cogent semblance of this phallus? What does it look like? What is its Imaginary? What is its future? The present analysis leads me to conclude that the ideological phallus of mathematics education, signified as it is through the masculine-quilted-speech, looks like Capital. What is it that gender equity researchers desire? Do we desire the Real, do we desire the feminine, do we desire the desire of the Other? Or, as it seems more likely in light of the present study, do we desire the market?

---

76 This is a bold claim for Lacan, because the sexual relationship doesn’t exist; for Lacan to suggest an interstice—a ‘cut’—wherein the sexual relationship may have its possibility instituted, it should cause any psychoanalyst to take pause. For mathematics education, this means that the sexual relationship has an (im)possibility where the masculine quilted speech of mathematics joins with the mathematical ‘it’s written’—the function of mathematics in political economy. This function is a phantasm that operates within—or perhaps, because of—the failure of the sexual.
REFERENCES

(Excluding Data Citations; see Appendix I)
References (Excluding Data)


(Original work published 1807)


(Original work published 1959)


(Original work published 1947)


(Original work published 1962)


[https://www.lacaninireland.com](https://www.lacaninireland.com) (Original work published 1967)


https://www.marxists.org/archive/marx/works/1867-c1/index.htm (Original work published 1867)


https://www.marxists.org/archive/marx/works/1845/german-ideology/ch01.htm (Original work published 1846)


APPENDIX I: REFERENCES FOR DATA
Appendix I: References for Data


Sumpter, L. (2022). “The question is not why I don’t work in a maths department; the question is why would I?”: Women mathematicians’ experiences of power relations and gender symbols during their PhD. *Education Inquiry*. Advance online publication.

[https://doi.org/10.1080/20004508.2022.2047445](https://doi.org/10.1080/20004508.2022.2047445)


