A Foucauldian Analysis of Mathematical Discourse

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> *The important thing, I believe, is that truth isn't outside power, or lacking in power: contrary to a myth . . . truth isn't the reward of free spirits, . . . nor the privilege of those who have succeeded in liberating themselves . . . Truth is a thing of this world . . . Each society has its regime of truth: that is, the types of discourse which it accepts and makes function as true . . .* [1]

As I read these words of Michel Foucault, I cannot help but become more aware of the politics of my own teaching of mathematics. If I take my study of Foucault seriously, I must think about changing my teaching practices. In the past, I saw improvement or change in my teaching as a personal endeavor; now, however, it has become more than that—it is a political struggle in which I have begun to question how the teaching of mathematics has been constructed to empower certain individuals who engage in certain practices. Foucault has helped me identify the construction of mathematics as well as to diffuse some of my anger concerning the traditional teaching of mathematics. His work provides me with means to articulate the contradictions I have been feeling in my teaching and to identify other ways of viewing and teaching mathematics.

As a graduate teaching assistant in a university mathematics department, I taught the "weeder" calculus courses as I finished my master's degree. The Mathematics Department functioned as a service department to the Engineering Department. The first-quarter freshman calculus course had enrollments of several hundred young men, and the rigor and disconnectedness with which I taught the classes and gave the exams guaranteed that the filtering process started the first quarter. This unfeeling approach continued for these students through six or more quarters of calculus and differential equations.

I never thought about this practice even though I did not particularly enjoy sensing the frustration of so many students, particularly many of the women. What I enjoyed was a deluded sense of separateness from those who struggled with their prejudices, irrational decisions, and generally messy lives. I played with fantasies of obtaining my master's degree and becoming a mathematician in an area with few women. But what Foucault has suggested to me is that in teaching mathematics courses, a way of knowing is modeled and supported that sets the contents of mathematics courses "out there somewhere" for the chosen few to grasp like a golden ring on a merry-go-round; these chosen few are more likely to be men than women. I wondered how such a system is perpetuated—a system that seems to be the result of the incorporation of a masculine structuring, masculine concerns, and masculine discourse in the sciences.

In this paper, I will use the ideas of Foucault to analyze how gender is conceptualized in the teaching of mathematics. More specifically, I will bring out features implicit in the teaching of mathematics that continually support and perpetuate a dominant discourse of "truth" in the world of mathematics that reflects a male perspective on the world. My data will be various components of mathematics discourse as I have observed them in my own experiences as an instructor of mathematics. I will use as my method of analysis Michel Foucault's notions of power and knowledge as they function to create and support discursive formations. While some feminist scholars in the social sciences have used Foucault's writings to conduct feminist critiques, none have applied his ideas to the discipline of mathematics. [2]

In talking about the term "masculine" here, I do not wish to make this an issue of males versus females in mathematics classes. "Masculine" refers to a cognitive style, not a biological category. Traits of this cognitive style are objectivity, separation, control of knower over nature, and a strictly intellectual way of knowing that denies other ways of knowing. A feminine cognitive style represents centeredness, empathy with subjects and nature, and blurred boundaries between knower and known. Throughout this paper, I will use the terms "masculine" and "feminine" to refer to these two ways of viewing the teaching and learning of mathematics.

To introduce Foucault's works, I will review briefly his notions of power and knowledge as a starting point for analyzing discourse in the classroom that creates masculine ways of knowing mathematics and thus women who believe they are poor in mathematics. I then will show the utility of these theories in an analysis of mathematical teaching. I write this piece in the hope that readers will see the usefulness of Foucault's ideas in mathematics education and will begin to question their own practices in the teaching of mathematics.

Overview of Foucault's notions of power and knowledge

What is important about Foucault's work is his separation from usual theories of power. This is brought out in the afterword Foucault wrote for *Michel Foucault: beyond structuralism and hermeneutics*, when he says, "What characterizes the power we are analyzing is that it brings into play relations between individuals (or between groups) . . . the term "power" designates relationships

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between partners." [3] Here he gives us an interpretation of power as something that is not a possession that one group or individual holds while another lacks. He sees power as a multiplicity of relationships, and his work insists that people become aware of how they participate in power relationships—that they are not separated from power. Within the classroom, for instance, the student is an active and productive participant in power. Power is made and exists in every social interaction and classroom. It is not exercised in a repressive sense from outside the individual; rather, the site of power is within individual students and teachers. Power, to Foucault, is a multidimensional field of relationships or an ecology of relations, for instance, between teacher and student.

Foucault talks about the productive aspects of power. Power must be viewed not only as oppressive but as creative as well. [4] We accept power relationships and power produces knowledge and discourse. It needs to be considered as a productive network connecting an entire social body. He is saying that power relations are rooted in social network systems. Foucault abandons the notion of power as repression, particularly in *The history of sexuality,* and develops an account of power as something that constitutes the person.

Foucault warns that power should not be viewed in some universal form or as a commodity. It is not something people can hold; rather, it is exercised through individuals: "Individuals are the vehicles of power, not its points of application." [5] He asserts that power is not given or recovered but is exercised. His conception of power is further explained by emphasizing that power is more than just a relationship between partners. It is a way in which certain actions modify other actions; it only exists, he says, if it is put into action. Individuals need to look at the way in which actions modify other actions. He says:

> In effect, what defines a relationship of power is that it is a mode of action which does not act directly and immediately on others. Instead it acts upon their actions: an action upon an action on existing actions or on those which may arise in the present or the future. [6]

Foucault claims power does not act directly on people but on their actions. Here, he decenters individuals and examines their actions: "The exercise of power consists in guiding the possibility of conduct and putting in order the possible outcome." [7] For example, teachers, who are guided by textbooks, provide assignments clarifying and limiting what is to be studied and known. They then use examinations to determine which students are successful within the discursive frame.

Knowledge functions as a form of power and disseminates the effects of power—it is an expression of power and thus of relations among individuals. It is whatever one can speak about within discourses. New forms of knowledge, therefore, will translate into new expressions of power. Discursive practices, on which I will elaborate later, are equivalent to what is perceived as knowledge and power. Power that is spread throughout a discursive formation has an effect on the nature of the discursive practices. Knowledge is produced and induces power; therefore, each society has its discourse that it accepts as truth. In our society, for example, knowledge is a result of scientific discourse and findings.

According to Foucault, understanding his notion of power is a prerequisite to understanding his ideas concerning discursive formations within which discursive practices, rules, and roles exist. With the publication of *The archaeology of knowledge,* the term *discursive formations* took the place of his earlier term, *episteme.* The notion of *episteme* is defined as "the total set of relations that unite, at a given period, the discursive practices that give rise to epistemological figures, sciences, and possibly formalized systems." [8] The *episteme* of a given period or culture allows people to understand the constraints and limitations that are inherent in any discourse. An *episteme,* then, creates and orders the only way that people can think about the world.

Foucault gives new status to discourse when he introduces the term, *discursive formation.* With this term, he investigates, within common groups of people, the production and structure of discourse that frames knowledge. To clarify Foucault's theory of discursive formations, I will discuss, in more detail, his notions of discursive practices, rules, and roles.

Discursive practices

A discursive practice, in part, is a communicative speech act that embodies certain rules for knowledge. Within the discursive formation, the discursive practices are what govern knowledge and power relations. In defining discursive practices, Foucault is not so much concerned with everyday speech acts as he is with what he calls "statements". For example, the statement, "Mathematics is objective and unemotional", is a common speech act that does not necessarily concern Foucault. He becomes concerned, however, when this same statement is made within a classroom, perhaps by a scholarly professor, and is believed to be true by those who hear it. To Foucault this term, "discursive practices," is not limited to written and spoken discourse but includes non-verbal acts as well. In his own writings, discursive practices include such things as use of space in settings, religious or juridical texts, or people's interactions with other people and objects.

Foucault says a discursive practice is "a body of anonymous, historical rules, always determined in the time and space that have defined a given period." [9] A discursive practice creates knowledge: "There is no knowledge without a particular discursive practice and any discursive practice can be defined by the knowledge that it forms." [10] Although Foucault uses the terms, "discursive practices," he means for it to include all that which is accepted as true in a society. Another example of discursive practices, cited by Foucault in *Discipline and punish,* is Jeremy Bentham's architectural construct called the panopticon, which produces certain behaviors in the prisoners it houses. The spaces in the panopticon allow prisoners to be watched at all times so that the prisoners

learn to "gaze" themselves, thus policing their own and others' actions in order to stay in line with what is acceptable to prison rules

Analysis of discursive practices in mathematics

In this section, I will identify four discursive practices in the teaching of mathematics and make the case that each promotes a gender bias in the classroom—textbooks, teaching methods or styles, examination processes, and use of space in classroom. These practices follow certain rules and, to anyone studying or teaching mathematics, would create knowledge in the mathematics discourse. My point is to show that this discourse has adopted a masculine perspective and excludes the feminine voice.

Textbooks

Textbooks constitute a discursive practice that regulates the concepts that are taught and the order in which they are taught. Concepts are presented within a language framework of rigid categories. Here, students are encouraged to think in dualistic ways that dichotomize context from text. Women many times do not think in such well-defined categories, and this language can be interpreted as privileging masculine states of objective knowledge. This presentation reinforces the unrelatedness of ideas and puts out of focus different ways of knowing.

Most texts claims to include problems that are meaningful to students as well as teachers. Many new editions include brief historical anecdotes and cartoons—the claim is that anecdotes motivate students. Some authors use a more "relaxed" vocabulary to encourage students of diverse backgrounds to use the books comfortably. However, the word choice used in texts continues to affect the images of students—that mathematics is written by and for men. Females' expectations and success are affected by the male dominated images which are used in mathematics textbooks. For example, in a trigonometry book I reviewed, historical anecdotes are used at the end of sections to describe the development of the concepts. My initial reaction was to use these comments in my other classes; however, not one comment mentions a woman as an "inventor" of ideas. Men, it is written, "invented" mathematical concepts. The comments carry with them pictures of men, thus creating a male domain from which women students are excluded. Texts that use the pronouns "we" or "us" make me wonder to which community this word is referring.

Claims made in texts to provide an historical perspective to mathematics hardly allow for any connection between female learners and the subject matter. If an historical picture is shown of a mathematician, it is that of a man: if a cartoon is shown, too many times, it is a girl struggling with a concept. [11] The resulting image, even for those of us teaching math, is that serious mathematicians are (and historically have been) men. The perception is that mathematics was discovered by and is carried on by men; this notion is perpetuated by the titles of such books as *Men of mathematics* by E.T. Bell.

If an attempt is made to provide a context to problems, women students may not be familiar with the context. For example, recently a group I taught (mostly women) encountered a problem having to do with the rules of baseball. Successfully doing the problem was dependent on knowing how to play the game. Most of us could not work the problem, and I found myself reassuring the class that it was not the mathematics we could not do; rather, it was the context we could not understand. These kinds of problems need to be identified and pointed out to make instructors aware of the use of metaphors common only to males' experiences.

Many times, teachers will supplement the texts they use in order to give students a richer understanding of concepts. Supplemental materials given to me have been more examples of problems that already appear so decontextualized and disconnected in texts. These materials are, in fact, intended to develop ideas where the text is lacking. One area in which texts are lacking is mathematical contributions made by women! To bring about an connected knowing relevant to women, supplemental materials giving historical developments of concepts need to include readings of women who have contributed to mathematical theory. Literature is readily available about women (living and dead) who have studied and contributed to mathematics. I have had several female students comment that they would like to know more about these women. Also, local contributions should be considered valuable supplements to lectures. For example, the community in which I currently teach has a museum displaying the actual ten-thousand-year-old sandals referred to in a calculus text in the section about carbon dating. Sharing this with students is an excellent way to bring some continuity to their experiences and what they study in math classes.

Teaching methods

Another discursive practice of math classes has to do with teaching methods. All along, students see more male teaching mathematics. Many of us have the notion that men teachers, as knowers, pass out knowledge to students who passively receive facts and procedures. Much of the learning students do comes from observing and imitating their teachers. As female students observe behaviors and teaching styles of predominantly males, they decide which behaviors are appropriate to their role in the classroom. The message that comes out of many teaching styles is that mathematics is for males.

Because my lectures tend to be one way from teacher to student, females in my classes generally see the information and facts as separate from them. Those who ask the questions during lecture about why this information is important or how these facts are useful are *always* women! The "truth" here lies in the theory, which is outside female participants' experiences and is supplied by me in bits and pieces with the hope that they will internalize the theory by listening to lectures. This rarely happens! Authority and control are not given to truth that is found from these women's first-hand experiences in the classroom. Foucault emphasizes that theorizing is a form of practice that invalidates first-hand experience

ence. [12] Little teacher- or student-initiated discussion results from my monologues. If these women students do not see any connection between ideas presented within the discourse of mathematics, they certainly will not see connections of ideas to their experiences outside the class. If I open lectures with discussions of how ideas in the text relate to each other and if I reiterate these ideas daily, students pick up a thread that carries over from section to section. This is only my beginning to answer their questions about the importance of mathematical ideas to their lives.

Very early, female students learn from their teachers' methods that mathematical discourse is not one that allows room for sharing of opinions and ideas that contribute to learning math concepts. Just as texts do, in the past I have presented mathematical theories and tried to think of applications of them. A more relevant approach would be to elucidate mathematics that result from students' lives and experiences. Women in math classes would benefit from hearing stories about the importance of mathematics in other women's lives and how other women have managed to make mathematics relevant to their experiences. Articulating ways of learning mathematics could provide a thread between the masculine discourse of mathematics and women's lives. Teachers rarely use our immediate environment (patterns woven into fabric, knitting directions that demonstrate symmetry, etc.) to illustrate ways of thinking mathematically; rather, we use a *man*-made reality (buildings, cars, bridges, etc.) as exemplars of the world of mathematical thinking.

In the past, I recall asking males more questions while I was lecturing. Research shows that teachers have been observed to interact with males more often in the classroom and provide more opportunity for them to respond to questions. [13] Still other research reports that teachers have lower expectations for high school and college age females than males. [14] Teacher feedback significantly affects females' interests in mathematics. Women too often get the message from teachers that they can either be feminine or study such disciplines as mathematics.

Math instructors use vocabulary and syntax in ways students have never encountered. Many times, teachers make no sign that they notice the existence of students at all. Rather, they identify completely with the subject matter and engage in speaking unyielding eternal truths. For example, I have observed teachers standing with their backs to the students, writing mathematical symbols, and speaking in a tone of voice that makes clear that the symbols should be recognizable and therefore obvious. I have had math professors who would preface remarks about concepts which were totally obscure with: "It is intuitively obvious that. . . ." To describe ordered operations and procedures that are divorced from any social-historical realm, vocabulary used in lectures is kept purposely separate from students. The symbols used to describe operations become a "shorthand" that needs to be introduced over and over; this language can appear very alien. This feeling of alienation from the language and symbols instructors use can be overwhelming to many students. Methods of teachers are not concerned with the investigation of students' ability to translate meaning from natural language into algebraic symbolic language. Several bright students whom I have taught in the past (in every case females) have told me that they dropped out of their last in a sequence of calculus or statistics classes because they could not understand what the professor (in every case a male) was saying.

Students who are highly capable of learning mathematics may need to see or experience more interactive teaching styles. These styles represent a feminine cognitive learning style. For instance, teachers could ask students to write about their experiences of learning material and to share how they feel about the course. In the past, I have privileged certain forms of discourse. For example, I have not always allowed an opening for inquiry on the nature of the unspoken rules we all so mindlessly follow.

Lately, in classes I teach, one method I have used is to ask students to keep journals describing how they learn mathematical concepts and how they feel about their learning. Some write that they study with other people in the class and that they feel more comfortable with the group work we do in class. In one class, a woman wrote about the connection she saw between different number bases we discussed and her study of music. Another woman thought of an answer to a problem while jogging and wrote about how confident she felt in solving the problem. Initially, of course, some hesitate and claim there is nothing to write about in math classes; in the end, however, most agree the writing and sharing gives them a voice with me and a chance to show how they try to integrate concepts with their own outside interests. As I encourage students to reflect on their learning, I also realize that the pace with which we cover material does not allow for much introspection on the student's part. Such critical reflection of mathematical topics is not given priority in regular classrooms; thus, any time spent on reflection of ideas covered in class imposes additional demands on students.

Examinations

Examinations make up a third discursive practice in the teaching of math. Exams and quizzes are extremely decontextualized and continually are used to measure individuals' mastery levels. I have listened to many discouraged female students say they put in many hours studying (more than for any other class), and their grades do not reflect their efforts. I try to reassure them that their grades do not reflect their ability to learn mathematics, nor does their performance on exams necessarily reflect their seriousness about learning the material.

What these grades reflect has something to do with the style in which the exams are written and given. Typically, all students are given the same amount of time to regurgitate information they have consumed yet may not understand. Because writing paragraphs of their experiences in mathematics would not be seen as demonstrating knowledge, short-essay answers are not the norm on exams. Nor are students allowed to take tests in groups; this mode of testing would not show what the individual knows. Coop-

eration in learning is not validated in math classes, particularly on test days.

Every quarter, I give students a couple of quizzes that they complete in groups of their own making. In this way, students can share ideas and teach other students. We are all so conditioned in our detached individual ways of knowing that unless I model for them that to sit with others to process the material is valid, they feel they are cheating. By working cooperatively, they feel they are not demonstrating they know anything at all. In fact, by explaining their processes to other students, they are demonstrating their knowledge. I doubt their reactions would be the same in a literature or education class if they were required to do a group project that would be graded. Mathematics examinations clearly serve as a link between particular kinds of power relations and knowledge that is privileged. In this discursive practice of testing, a masculine cognitive style of disconnectedness for testing students is validated, while group efforts to complete exams are out of the question.

The usual examination style supposedly prepares students for national math exams that they will take throughout their college studies. National exams set standards that are believed to be relevant to all (female and male) students, and preference is given to individuals who can complete exams quickly and successfully that require them to consume the most amount of information. Students compete to collect credits and grades through this testing structure. Researchers consistently publish data that say males outperform females on national exams because males have a higher level of mathematical reasoning ability. [15] These research results are communicated as truths and the image is that men do well on exams and women struggle to pass the tests.

Even the practice of administering standardized exams is the show of a belief that groups can dictate to other groups what is important to know. In *Discipline and punish,* Foucault claims examination "is a normalizing gaze, a surveillance that makes it possible to quality, to classify and to punish. It establishes over individuals a visibility through which one differentiates them and judges them." [16] Knowledge is transmitted from teachers to students, who then are evaluated according to how they perform on the exams.

Use of space in classrooms

Finally, discursive practices are seen in the use of space within math classrooms. Desks are more commonly put in rows and columns in a matrix fashion, reinforcing the notion that student interaction should be limited. If the class faces the front of the room where the teacher typically stands, the little interaction that does take place is student to teacher and not student to student. This learning environment does not foster creativity or cooperative problem-solving strategies. Feelings of alienation in studying mathematics are reinforced in this environment. Individual desks that act as cells also reinforce the notion that mathematics can and should be done alone. The image here is that of the male mathematician sitting alone at his desk, "doing mathematics."

Research into the teaching of mathematics promote the idea that students learn mathematics well by studyin in groups, [17] but my observations show teachers sti require students to do the bulk of the work quietly at thei own desks. Rather than a classroom that instills fear an isolation and hinders students' freedom to learn, one ca be arranged to facilitate discussions as the norm. As encourage students to work together on quizzes, I ca filter through the groups, making the group the center o activity. Particularly if a group of women students se that they are working successfully, they are reinforce that their actions of networking are an important step t problem solving.

Analysis of rules in mathematics

Discursive practices are governed by certain rules c "conditions of existence, co-existence, maintenance, moc ification, and disappearance in a given discursive div ision" [18] Rules are intrinsic to any discursive formatio and help to define it. Discursive practices, then, are char acterized by the interplay of these rules that typically ar not written out; nor can people usually articulate them.

Rules determine the possibilities and limitations for th content of a discourse. They determine the condition under which discourse is used, who can speak, how indi viduals must speak or write, and who speaks the "truth" Rules of our current discursive formation state that pris oners, children, and students are not listened to or given a voice. Rules also determine what can and cannot b talked about. For example, in *The history of sexuality* Foucault states that ". . . on the subject of sex, silenc became the rule." [19] Children's sexuality was not dis cussed or even known as a topic of discussion; thus, it dic not exist. Within the classroom, we use a shared set o rules as criteria for what can be discussed. Rules, fo example, determine what is not a part of the body o discourse or knowledge in math classes—what is no spoken about.

Another group of rules has to do with the form that theories must take in order to be seen by people as truth within any discourse. These rules determine the vocabulary that must be used in stating the truth. Even the arrangement of statements follow these rules [20] For example, my thoughts and my statements in writing this paper must appear to readers in a linear fashion in order to be recognized as appropriate within our discursive formation. There is no recognizable knowledge in statements that are seen as non-linear or in statements that do not follow our prescribed order.

Within the discursive formation of mathematics teaching, rules determine what can be said and thus known. What constitutes knowledge in math classes is the result of the operation of various rules. Absent from the teaching of mathematics are such things as free discussions among students that lead to discovering processes that give correct solutions, students making choices of topics to cover, or an expression of feelings about mathematics. Texts are designed to make solutions look obvious and neat; syllabi are created that lock us all into a strict time schedule, thus preventing student choices; and the style of

presentation of mathematics reinforces to students that the study of mathematics is an unfeeling arena of mind meeting mind

Examples of what constitute objects of discourse are expert teachers acting as organized translators of knowledge and students neatly following procedures of the textbooks. What students never see is the "messiness" of mathematics All they get is a glimpse of the sequential, logical results whether, in texts, from lectures, or in seminars. Students do not get a chance to see the expert teacher grapple with concepts or try to sort out information. (I see instructors struggle with their ideas with other instructors daily but not with students.) We all hold to the illusion that mathematics is a neat, orderly discourse. As a result of all this perceived tidiness, students never feel comfortable with their own frustrations. A show of frustration is not allowed as part of this body of discourse by those who instruct; therefore, students do not accept their own frustration as natural.

These rules produce a masculine discourse, which feeds into the imbalance of power relations that exist in the classroom. Women are more likely than men to feel that the rules and rites of the mathematics community create a foreign environment.

Analysis of roles in mathematics

Rules, produced by discursive practices, produce particular kinds of roles for individuals Within a discursive formation, the speaker as a person or an individual has little relevance to Foucault. Individuals who speak or write are only acting out particular roles that many others also could assume. The discursive formation creates roles and defines them for the subject, giving certain role players license to be heard, while many individuals continue with no voice. Foucault is not interested, for example, in what personal characteristics make a doctor but in the rules those who practice medicine must follow to maintain their role as doctor By assuming particular roles, individuals speak the knowledge of a discursive formation. To put it another way, the language, with its attendant rules and prescribed patterns and social relations, can be thought of as speaking the individual. Some roles are validated more than others within a discursive formation. This recognition has little to do with inherent abilities of individuals.

Foucault's notion of roles suggests that the discursive practices of the teaching of mathematics produce teachers with particular behaviors and styles—teachers who take on the prescribed role of the mathematics educator The role of the teacher is that of expert, knower of facts and procedures, and controller. A dynamic exists that puts the teacher in a predominantly masculine role, while students are sentenced to accept their passive positions. Students view the teacher as pre-planner or authoritarian, who must organize the class to deliver information in an effective way to measure what is learned. The classroom is seen as made up of competitive individuals by the teacher

These roles do not allow for the students to be teachers or vice versa In this way, the asymmetry of power relations is maintained between teacher and students. Those who conform to these roles (teachers and students alike) are likely to have their voices heard in the formation.

Conclusion

We can see, then, that the structure of the discourse of mathematics has immense implications for its teaching. In their learning, students become submissive to the ways of mathematics Mathematical discourse functions to inculcate students who study mathematics with the idea that they are the passive recipients of cold hard facts that they must memorize to pass each class. It is a very controlling discursive system, and its status in our technological society causes individuals to accept this discourse as normal

Within the four discursive practices I have described, masculine gender biases clearly predominate. Students and teachers usually are not conscious of these tendencies and many times cannot articulate gender as an issue and its connection to power relations. Even though they govern the dynamics of the class, masculine norms usually are not recognized or articulated as such in math classes. However, an asymmetry in the teaching and presentation of mathematics does exist, and this needs to be recognized in the context of masculine and feminine teaching and learning styles.

Foucault's theory contributes to the gender debate in the sciences Use of his theory to analyze the gender constructions in math classrooms shows the utility of that theory in order for teachers, as well as students, to begin to understand the discourse of math that affects females who study it. I claim the gender biases associated with mathematics were not created in isolated domains at all. Use of masculine practices is privileged over feminine ways of knowing; one type of knowledge is favored over another.

The discursive practices, rules, and roles of mathematics classes bring about what Foucault refers to as normalization of the subject Female students quickly learn to adopt and identify with appropriate masculine gender roles. Within the discursive formation, a prescriptive power controls the actions and behavior of students and teachers; these actions are those of a masculine style. To allow for a balance of power relations among students and between students and teachers, these masculine biases need to be supplemented with more feminine ways of learning to allow for more females to continue their studies in mathematics—whether to do research or to teach. A change in power networks would result in new forms of knowledge and discourse within classes—a discourse that takes into account the experiences and needs of women who study mathematics and who teach it. A constant renegotiation and reinvestigation of knowledge definitions, therefore, must take place

What individuals will get out of using the theory of Foucault, I hope, is that those teaching and studying mathematics can bring about incremental changes in the discursive formation. If we understand something of the unspoken practices and rules of a formation, we then can talk about why some statements are seen as valid and some are not If we understand about roles that teachers

and students adopt, we can question our roles and those of others.

Mathematics education, regardless of the approach, is based on commonly held views of mathematics philosophy. For example, if teachers view mathematics as objective and without emotion, their teaching practices will reflect their ideology. Beliefs formed about the academic study of mathematics affect mathematics pedagogy. Therefore, to describe a completely different view of mathematics education would involve reconceptualizing new theories to comprise an adequate philosophy of mathematics; such a reconstruction is beyond the scope of this paper. My view is that a beginning point for these new theories would necessarily be built on *human* experiences and social interactions. This new epistemology then would reflect in math education new forms of mathematics knowledge.

I hope that my analysis gives my readers insights into how discursive formations are constructed and maintained and some options available to those who teach mathematics and who are interested in breaking away from the accepted formation. Foucault encourages us to question the taken-for-granted status of mathematical discourse, along with the notion that mathematics is value and gender free. Mathematics can be and needs to be understood as a constructed discourse that, with its practices and rules, affects our concept of truth, accepted methods of learning, and many attitudes within the cla room

Notes

[1] Michel Foucault, *Power/knowledge: selected interviews and ot writings 1972-1977* trans. Colin Gordon et al. ed. Colin Gord (New York: Pantheon, 1980), 131

[2] Irene Diamond and Lee Quinby, eds. *Feminism and Fouca* (Boston: Northeastern University, 1988)

[3] Hubert Dreyfus and Paul Rabinow, *Michel Foucault: bey structuralism and hermeneutics* (Chicago: University of Chica 1983), 217

[4] Michel Foucault, *Power/knowledge*, 119

[5] Michel Foucault, *Power/knowledge*, 198

[6] Hubert Dreyfus, *Michel Foucault* 220

[7] Hubert Dreyfus, *Michel Foucault* 221

[8] Michel Foucault, *The archaeology of knowledge* trans. A. Sheridan Smith (New York: Pantheon, 1970), 191

[9] Michel Foucault, *The archaeology of knowledge* 117

[10] Michel Foucault, *The archaeology of knowledge* 183

[11] Michael Sullivan, *College algebra and trigonometry* (San Fr cisco: Dellen, 1987); and Rick Billstein, et al., *A problem solv approach to mathematics for elementary school teachers* (Me Park: Benjamin/Cummings, 1984)

[12] Michel Foucault and Gillies Deleuze, "Intellectuals and Powe *L'Arc* (1972): 3-10

[13] Louise Wilkinsin and Cora Marrett, *Gender influences in cla room interaction* (Orlando: Academic, 1985), 17-55; and J Becker, "Differential Treatment of Females and Males in Mat matics Classes," *Journal for Research in Mathematics Educati* 12 (1981): 40-53