Counting on You: The Rhetoric of the National Council of Teachers of Mathematics "Standards".

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COUNTING ON YOU: THE RHETORIC OF THE NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS STANDARDS

A Dissertation

Submitted to the Graduate Faculty of the Louisiana State University and Agricultural and Mechanical College in partial fulfillment of the requirements for the degree of Doctor of Philosophy

in

The Department of Speech Communication

by

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ABSTRACT

This study sought to initiate the process of identifying the rhetoric of mathematics as a distinct field of research, while acknowledging its basis in the rhetoric of science and other literatures. Accordingly, the study started by examining the external basis of the rhetoric of mathematics; in other words, how discourse affects the way in which the culture views mathematics.

The primary text for this study was the National Council of Teachers of Mathematics' three-volume *Standards for School Mathematics*. This document, designed to reform mathematics education from kindergarten through twelfth grade, was shown not to be completely successful in its goal of encouraging teachers to adopt its viewpoint.

A synthesis of narrative theory and movement theory was used in this analysis. Marie Maclean's and Susan Lanser's conceptions of narrative were used to ground the theoretical framework, with Didier Coste's work used to bridge the gap between literary conceptions of narrative and communication theory.

The study also examined the *Standards* as a movement, using Ralph Smith and Russell Windes' approach to the study of innovational movements. The NCTM had aspects of a transformational movement as well as an innovational
movement, but did not completely belong to either type of movement.

This study also examined the NCTM as an expert rhetor, using Thomas Lessl's conception of scientific rhetors who move into the public sphere. The study examined how expert rhetors must ultimately exhort fellow members of an elite subgroup, while at the same time, encouraging new members to join.
CHAPTER 1
INTRODUCTION

Introduction:

At least since Plato, thinkers have believed that mathematics is divine, perfect, certain, infallible, and self-evident (Holladay 74). Barrow contends, "One of the cornerstones of human thinking from the early Greeks until the 19th century had been the certainty offered by Euclid's study of geometry" (9). Geometry, along with arithmetic and logic, comprised the majority of mathematical thought. Mathematics was intimately intertwined with philosophy. To understand philosophy required an understanding of mathematics, and vice versa. Many of the great philosophers of the time were also renowned in mathematics. Aristotle, for example, contributed greatly to the study of logic and geometry. Additionally, the philosophical underpinnings of mathematics were important in other fields, including architecture, navigation, astronomy, and even religion, through the Enlightenment (Barrow 10; Kline Mathematics the Loss 4). Mathematicians since ancient times have believed that what once was good in mathematics will always be so, and that what was good will always be at the core of mathematical knowledge (Aaboe 2). Kline summarized a view popular in the past: "Whenever someone wants an example of certitude and
exactness of reasoning, he appeals to mathematics" (Mathematics the Loss 4).

Mathematics was also linked to the field of rhetoric from the time of Aristotle and Plato. Aristotle's Rhetoric clearly showed the intimate connections between logos and geometric forms. Plato makes use of geometric problems in the Meno, where he used the example of the square root of eight to highlight the use of paradox. According to Plato and Aristotle, in order to understand mathematics completely, one had to understand rhetoric, and vice versa. The schools of Plato and Aristotle required students to be proficient in a variety of arts, including mathematics and rhetoric, and one could not be a full-fledged scholar unless one understood both rhetoric and mathematics. Mathematics was based on logic, reasoning, and persuasion, all of which were intimately tied to rhetoric. To investigate the links between rhetoric and mathematics, then, we must first start by defining the terms "rhetoric" and "mathematics."

In this dissertation, I will take for my definition of rhetoric that offered by Bizzell and Herzberg: "the concerns of rhetoric [are] nothing less than the foundations of knowledge and ideology in discourse" (921). Rhetoric is not necessarily confined to persuasive forms; in fact, "it is also a field of inquiry, a complex and sensitive theory of language that seeks to describe its operation in human affairs" (Bizzell and Herzberg 919). Rhetoric, then,
operates within all realms of human affairs, both scientific and humanistic.

I choose this particular definition for two reasons. First, to study the history of mathematics, especially the way mathematical ideas are promulgated in the social world, is to study the foundations of mathematical knowledge. In Kutzko's view, to understand mathematical usage, one must understand shared experience—a shared experience based on foundational knowledge (16). Shared experience, as argued by many rhetoricians, is based on symbols. Symbolicity applies to "all other human symbol systems, such as mathematics" (Burke Language 28).

Secondly, mathematicians have long sought to apply their work to human affairs. While the link is becoming increasingly tenuous, mathematics, especially at elementary levels, is based on making connections between mathematics and other subjects. Students in the fifth to eighth grades, for example, are called to "apply mathematical thinking and modeling to solve problems that arise in other disciplines, such as art, music, psychology, science and business," and to "value the role of mathematics in our culture and society" (Curriculum 84). Accordingly, since mathematics can be thought of as a language, it may be fruitful to examine mathematics through a rhetorical lens.

Of course, many different conceptions of mathematics exist, for mathematics "is a form of social interaction where
'proof' is a complex of the formal and the informal, of calculations and casual comments, of convincing argument and appeals to the imagination and intuition" (Davis and Hersh 68). The definition of mathematics that will be used in this essay comes from Lynn Arthur Steen, who claims that mathematics "is not just about number and shape but about pattern and order of all sorts" (2). This particular definition is valuable because it recognizes the variety of algebras and geometries that have arisen in the past 150 years of mathematical research. Given that not all of mathematics can be visualized, especially without the aid of a computer, we are forced to turn to an alternate conception of mathematics.

A major question for philosophers of mathematics is whether mathematics is a human creation, or if mathematics is simply a matter of discovering a divine creation. This question is of extreme importance for rhetorical scholars, because if mathematics is discovered, rhetoric serves a inferior role to logic. If, however, mathematics is created, rhetoric may play a major role within the actual conceptualization and construction of mathematical systems. In either case, of course, rhetoric may play a vital part in persuading others to adopt a particular mathematical stance. If, for example, we create branches of algebra, rhetoric becomes an intervening force by which mathematicians are convinced that the created branches are valid.
The fact that mathematics as a discipline has changed dramatically in the past 200 years lends credence to the view that rhetoric intervenes in mathematics. Given that there is no universally accepted definition of what constitutes mathematics, as well as no indisputable body of knowledge for mathematics, mathematics seems to be a discipline negotiated by humans, and ultimately, a human creation. (Kline Mathematics and the Search 207).

The traditional view of mathematics is that mathematics and logic are related. However, while logic is innate to mathematics, logic is not the essence of mathematics (Kline "Logic" 272). Logic is not based in formalistic principles, but rather, as Toulmin might suggest, within a particular discourse community. McCloskey argues the same point this way: "Ethos-building and boundary battles are not, I think, to be set aside in any field, including mathematics" (H-Rhetor). Thus, mathematicians help determine their discipline's boundaries, as well as what will be accepted as mathematics. As Bell opines, "We do as we please about 'truth,' making our own mathematical postulates and agreeing to use a particular set of rules, called the postulates of logic, to deduce consequences from our freely created postulates" (153). Mathematicians, then, define the rules of how mathematics is practiced.

The belief that mathematics is a type of discourse is certainly not new. David Pimm argues for the metaphor of
mathematics as language: "metaphor is as central to the expression of mathematical meaning as it is to the expression of meaning in everyday language" (10-11). Philosophers of science distinguish the language of mathematics from the discourse of logic.

To say that mathematics is rhetorical, however, is to say that mathematics serves a significant persuasive role both within and outside of mathematical research (Davis and Hersh "Rhetoric and Mathematics" 59). Mathematicians require rhetoric in order to present their ideas to other mathematicians. Sekiguchi's claims about the persuasive nature of proof are illustrative of this point: "'Explaining a proof to other people' is not just presenting a proof; the mathematician has to try to convince other people" (21). Davis and Hersh suggest that we turn to mathematical utterances to see the ways in which mathematics is rhetorical.

Clearly, a major genre of mathematical utterances is the proof. In proofs, rhetoric plays important functions. As Kitcher notes, the persuasive aspect of proof serves a rhetorical function: "some proofs will be too long and complicated to serve their epistemic functions without explicit commentary" (Kitcher "Persuasion" 7).

So far, I have been looking, in a general way, at the rhetoric of mathematics internally. By an internal examination of the rhetoric of mathematics, I mean the ways
in which discourse shapes the philosophy and practice of mathematics. Such "internal" rhetorical mechanisms continue to be very controversial, both within and outside the discipline of mathematics. For the most part, such criticisms have been relegated to the sociology of mathematics. However, we might also consider a less controversial, more extrinsic dimension of mathematics, which would be more concerned with how mathematics shapes cultural discourse and practice. My primary concern in this dissertation will be extrinsic: with how rhetoric operates when mathematics is discussed within the culture.

One of the clearest places to see how mathematics operates within the culture is to look at the educational system. While college students can sometimes place out of mathematics courses, grade school and high school students have to take mathematics as a part of the overall curriculum. These formative years often predispose a student toward liking or disliking mathematics. If we are to understand how mathematics is discussed and understood within the culture, we must look at how mathematics is articulated in the educational context. While it is certainly possible to look at mathematics from the student's perspective, another profitable way of examining the extrinsic rhetoric of mathematics is to look at the teacher's perspective. Consequently, in this study, I will focus my attention on the statements of the National Council of Teachers of Mathematics
(hereafter NCTM). The NCTM is an approximately 120,000 member organization devoted to the teaching of mathematics from grades kindergarten through twelve. The membership includes teachers, specialists, and professors of mathematics and mathematics education. The NCTM's responsibility is to promote mathematics and mathematics education in schools, as well as to educate the public about the benefits of mathematics. The NCTM lobbies Congress to ensure that schools receive adequate funds for mathematics education, and to have more certified teachers in schools. Hence, the NCTM has a very clear and extremely important role in the shaping of public discourse about mathematics. As we will see, the NCTM's discourse also extends to within the mathematical community.

Discourse and the Culture of Mathematics:
Several authors have tried to consider the role of discourse in examining the cultural milieux of mathematics. John Allen Paulos brought the term "innumeracy" to the American consciousness in his 1988 book, *Innumeracy: Mathematical Illiteracy and its Consequences*. In the preface of his book, Paulos claims that his purpose in writing was to debunk some of the myths surrounding mathematics. These myths, which include flaws in statistical reasoning, a failure to appreciate mathematics, and a belief in pseudoscience, arise from a lack of numerical perspective
Paulos argues that the reasons for innumeracy are "poor education, psychological blocks, and romantic misconceptions about the nature of mathematics" (98). Discourse plays a slight role in romantic misconceptions, according to Paulos. Paulos notes that many people see numbers as taking on a depersonalizing function (122; Merriam). That, however, is the extent to which Paulos looks at the cultural discourse surrounding mathematics. His intention at the outset was to write a descriptive book about a set of experiences many innumerate people share. His intention was not to do a sociological or discursive analysis.

However, Sheila Tobias does more analysis of the cultural problems in learning mathematics. Her Overcoming Math Anxiety is primarily an ethnographic study that attempts to discern why people have problems with mathematics. In her view, the ambiguity present within mathematical discourse contributes greatly to people's mathematics anxiety. She cites as an example of mathematical ambiguity the equation \( \frac{1}{4} \div \frac{1}{2} = \frac{1}{2} \). Most people would assume that when you divide a bigger number into a smaller number, a smaller number should result. Indeed, the whole numbers work that way: the equation \( 3 \div 5 \) gives us a number smaller than one. However, in the case of fractions, we can obtain a number equal to or larger than the starting number, such as \( \frac{1}{4} \div \frac{1}{2} = \frac{1}{2} \). We often take "divide" as "to make smaller," when in reality, it has a completely different mathematical meaning.
Finally, Davis and Hersh's "Mathematics and Rhetoric," is perhaps the best treatment of the rhetorical dimensions of mathematics that exists. As Davis and Hersh remark, "within the practice [sic] of mathematics itself, among the professional mathematicians, continual and essential use is made of rhetorical modes of argument and persuasion in addition to purely formal or logical procedures" (58).

Davis and Hersh consider three cases: mathematics as rhetoric, rhetoric as mathematics, and rhetorical mathematics. They dismiss the latter, noting that it is neither pure nor applied, where "no practical consequences issue from rhetorical mathematics--except publications, reports, and grant proposals" (58). The study of cliometrics is an example of rhetorical mathematics.

Davis and Hersh concentrate their efforts on the role of rhetoric in mathematics, and more specifically, on the role of proof in mathematical journals. They operate under a traditional definition of rhetoric: "natural discourse which serves to convince" (64). Davis and Hersh then make the distinction between the philosophy of mathematics and the truth of mathematics. In their view, the philosophy of mathematics is based on rhetoric. Rhetoric is the mediating force between competing philosophies of mathematics, but for Davis and Hersh, there is an ideal philosophy, as yet undiscovered. This ideal philosophy is where truth resides, and is not affected by rhetoric. However, "mathematical proof
has its rhetorical moments and its rhetorical elements" (64). For example, proof by induction is rhetorical. The mathematician sketches out the proof by arguing for several cases, such as \( n = 2, n = 3, n = 4 \), and then argues the rest of the proof follows the same reasoning. The mathematician never proves this deductively, but asserts inductively through the use of rhetoric that the proof is correct (Davis and Hersh 60). Since an inductive proof cannot prove every case, but rather assumes that several cases represent the whole, the mathematician must convince other mathematicians that the proof is valid. The mathematician must turn to discourse in order to argue that the proof is sufficient.

Davis and Hersh go on to argue that all proofs by standards of formal logic are incomplete. However, there is still the practical question of adjudicating proofs as to their completeness and correctness. As Davis and Hersh point out, though, no explicit answer can be given to the question of what constitutes a mathematical proof (66).

Davis and Hersh close their essay by arguing that "Mathematics in real life is a form of social interaction where 'proof' is a complex of the formal and informal, of calculations and casual comments, of convincing argument and appeals to the imagination" (73). The social nature of mathematics places it within the bounds of rhetoric, where rhetoric works by persuading mathematicians to adopt positions through aesthetic and pragmatic appeals.
Each of these approaches in isolation is problematic for discussing the way in which we talk about mathematics in our educational institutions. I will examine each of the works reviewed in turn.

Paulos' major problem is that his work is not academic, and that his basic solution is to "be more mathematical." The book does provide a sense of what a mathematician feels is the cultural view of mathematics. While this approach certainly helps the reader understand more of the content of mathematics, it does not explain why people became innumerate in the first place, or the role rhetoric and discourse may have played in innumeracy. His work was not designed to be analytic or prescriptive.

Tobias looks at the experiences of individual learners, but does not apply these lessons to the culture at large. She sees her work as prescriptive, rather than descriptive in nature. While the literature suggests that there are a significant number of innumerate$^{10}$ people, Tobias' work assumes that their experiences are generalizable. Additionally, while ethnography is helpful, it is not concerned with larger issues of rhetoric or how rhetoric may be an emancipatory and/or an inhibiting force in math education.

Finally, although the Davis and Hersh study makes for an excellent starting point, it leaves the reader with several key questions. First, do all mathematical communities use
rhetoric? Do different mathematical communities (beside mathematicians) use rhetoric differently? How do we communicate about mathematics?

The Rhetoric of Mathematics as it Relates to Science:

Ultimately, in order to understand the rhetoric of mathematics, some claims must be demonstrated about the rhetoric of science. Gregory proposes that the "true language of physics is mathematics" (154). Mathematics and science are inextricably linked; "In formulating scientific theories, the exactness of a mathematical discipline is sought by organizing a system of assumptions, often, but not always, based on experimental results, and then by applying the formalism of deductive reasoning" (Greenspan 62). The rhetoric of mathematics is predicated on an understanding of the rhetoric of science.

The claim that science is rhetorical is becoming rapidly accepted. Few doubt the argument of Campbell, who notes, "Even scientific discourse must be persuasive to rescue insight from indifference, misunderstanding, contempt, or rejection" ("Charles Darwin" 69). The basic premise of Campbell's and similar views is that the scientist as an author perceives a reaction between the text and the audience; in other words, how does an author see ideas interact with an audience, and how does the author modify discourse to gain a better hearing? ("Reply" 315). The same
conclusions are accepted by the philosopher and historian of science Philip Kitcher, who writes, "Rhetorical effectiveness demands knowledge of which elements need to be mentioned, which can be omitted" ("Persuasion" 8).

The rhetoric of science impacts general rhetorical practice through the changing of public space. As Mary Lievrouw states, "the scientific community employs various communicative processes and structures in a strategic manner that help the community preserve the privileged status of scientific knowledge in American culture" (1). Rhetoric serves to make policy decisions. Steve Fuller argues, "we witness rhetoricians of science positioning themselves as rhetorical agents in not merely interpreting, but in actually changing the practices of their audiences" (310). The majority of the research in the rhetoric of science has involved the efforts of scientists to persuade one another.11 The rhetoric of science, at its core, is concerned with what rhetorician Thomas Lessl has called expert discourse. In Lessl's view, it is critical to study how scientists, considered to be experts by the general public, communicate when they enter the public sphere. The public scientist must walk a fine line; the scientist must somehow maintain the "sacredness" of scientific rhetoric while at the same time making that rhetoric at least partially accessible to the general public. The public scientist's message, then, is
judged both by the scientific community and the general public.

Both the rhetoric of science and the rhetoric of mathematics share a concern about each discipline’s portrayal in a public form, which is true of the rhetoric of inquiry movement in general. While mathematics certainly has an intrinsic dimension, my concern is with how mathematics is portrayed to the general public. Thus, this study seeks to begin the process of identifying the rhetoric of mathematics and examining the rhetoric of mathematics within a specific cultural practice.

My analysis is aimed primarily at two different communities. First, this study addresses the community of rhetorical scholars by enlarging the rhetoric of inquiry project. It suggests that the rhetoric of mathematics is a new area in which we can investigate the ways in which rhetoric affects particular populations, as well as how the rhetoric of mathematics strengthens the claims of rhetoricians of science. Additionally, this investigation speaks to the mathematics education community. Since the NCTM is the largest and most influential organization of mathematics teachers, an analysis of the NCTM and its rhetoric is significant in a time where mathematics education is undergoing great reforms.
Extrinsic Mathematics: NCTM and the Post-New Math Paradigm:

Perhaps the most well known conflict within the mathematics community and the larger culture is the so-called "modern mathematics" or "new mathematics." In 1955, the College Entrance Examination Board composed a desirable curriculum for high school mathematics. The National Council of Teachers of Mathematics followed in 1959 with a series of recommendations. Part of the reason was cultural: educated adults simply could not remember mathematics, and as Kline claims, "did not hesitate to say that they got nothing out of their mathematics courses" (Why Johnny 15).

The goals of the new math were straightforward. First, mathematics for small children was to be looked at as "a combination of several mathematical sciences, each contributing in simple ways to children's competency with numbers" (Corle 244). The new math was also supposed to bring about a more careful use of quantitative vocabulary, as well as an increased emphasis on understanding computations and giving the responsibility of learning back to the children (Corle 244-245). Ultimately, the new math was based more on theory than on facts and formulas (Nevins C2).

Many have labelled the "new math" as a failure. Vobejda echoes many of the critics when she argues that because the new math curriculum was written without the help of classroom teachers, classroom teachers had no stake in understanding or desiring the new math to succeed (A7).
As Kline notes, however, the "extent of the disaster was more evident at the primary school level. When students could not add 9 and 8, almost everyone was shocked" (Why the Professor 190). Many were quick to blame the method of teaching being used. Certainly, there have been critiques of "new math" as a method, including the fact that new math accelerated some children into new material while not forcing other children into repetitive course sequences. But part of the reason "new math" failed is because many teachers did not have the requisite background to understand the new curriculum (Osborne and Kasten 22).

The "new math" was followed by a series of reforms in the 1970's designed to improve sagging test scores in mathematics (Sowder 1). One of the consequences of this action was to find out what students did not know, and then drill them to have the students learn those topics (Osborne and Kasten 23). As a result, the basic skills movement began to flourish.

Kline continues, though, by pointing out the major strategical flaw in the New Math: it was never publicly defended. No documents or studies were written that justified the curricular choices of the New Math. The term itself, however, was appropriate for the time period: modern mathematics suggested innovation and reform, and insinuated that modern ways were better than old ways.
There has long been a perception that mathematics is peripheral to the American educational experience. In Steen's judgment, "many people manage to organize their lives so that they make virtually no use of mathematics" ("Numeracy" 215). The typical cultural view of mathematics includes "perceptions that mathematicians are responsible for making mathematics hard and that only geniuses are capable of learning mathematics" (Everybody Counts 11). Dawson cites the lack of concern of many when he writes, "the concern over mathematics appears distant and esoteric to many" (E12). Furthermore, what happens to children is that these stereotypes are reinforced in the classroom. "Unfortunately, as children become socialized by school and society, they begin to view mathematics as a rigid system of externally dictated rules governed by standards of accuracy, speed, and memory" (Everybody Counts 44).

The ways in which mathematicians and non-mathematicians view mathematics are polar opposites. In Bell's view, "There is probably no other science which presents such different appearances to one who cultivates it and one who does not, as mathematics. To [the noncultivator] it is ancient, venerable, and complete; a body, of dry, irrefutable, unambiguous reasoning. To the mathematician, on the other hand, his science is yet in the purple bloom of vigorous youth" (cited in Bell Development v). Indeed, the way in which mathematicians and non-mathematicians perceive math is
not just emotional. Steen observes that for the public, new branches of mathematics are "terra incognita. Mathematics, in the common lay view, is a static discipline based on formulas taught in the school subjects of arithmetic, geometry, algebra, and calculus. But outside public view, mathematics continues to grow at a rapid rate" (On the Shoulders 1).

Mary Lindquist, former President of the National Council of Teachers of Mathematics, wants to make mathematics "front page and prime time" (3). The NCTM proposes to move mathematics through its three volume standards for teaching mathematics.

Considering the NCTM Standards as a rhetorical text is important both within the public sphere and within the rhetoric of mathematics. In the public sphere, more attention has been paid to education and standards. Whereas in 1980, the mere mention of national standards of any kind would have been considered verboten, talk of national standards is fairly common today, including the discussion of outcome based education. The NCTM Standards are among the first of a variety of standards for disciplines including English, history, and even physical education.

Many in the mathematics education community see the Standards as vital. The Mathematical Sciences Education Board (MSEB) contends, "it is vitally important for the United States that assessment be based on instruments that
are properly aligned with the *Standards* (4). Indeed, as another MSEB document points out, virtually every professional mathematical science organization has supported the NCTM *Standards* (*Counting* 11).

The NCTM has seen itself as the leader in curricular reform in this country, both within mathematics and outside of mathematics. One of the goals of the *Standards* is to suggest a research agenda with regard to all teacher education (*Professional* 193). The *Standards* include not just mathematical content but also pedagogical theory; the *Standards* greatly advocate student-centered learning and a change in the teacher's role from leader to facilitator. It is the hope of the NCTM that changes in pedagogical theory transmit to all classrooms. The *Standards* are central to the NCTM's quest to be at the head of curricular reform: "we are confident that this document [the *Curriculum and Evaluation Standards*] represents the consensus of NCTM's members about the fundamental content that should be included in the school mathematics curriculum and about key issues concerning the organization" (v). The second volume of the *Standards*, the *Professional Standards for Teaching Mathematics*, was the next logical step: it presented "a vision of what teaching should entail to support the changes in curriculum set out in the *Curriculum and Evaluation Standards*" (vii). Since the organization sees these documents as the important statement
of its position concerning the role of mathematics in culture, it is important for us to examine the documents.

Textbooks are changing to meet the Standards. Advertisements in the major mathematics education journals, such as Mathematics Teacher and Arithmetic Teacher, proclaim that new books are in the spirit of the Standards. As a result, the Standards gain increased importance.

The NCTM also has made attempts to secure a larger audience for the Standards. They have produced, for example, a promotional video featuring a former member of the "Cosby Show" and a famous jazz musician, and have tried to make copies of the Standards available to school districts as well as school boards. Since the Standards are so critical to the long-term vision of the NCTM, they serve as an appropriate focal point for analysis.

Additionally, such disparate organizations as the National Council of Teachers of English, the National Education Association, and the National Association of Biology Teachers, all support the Standards. Given the great success of the NCTM Standards, a vitally important question to ask is what makes its rhetoric so successful.

Cultural Influences and Mathematics:

The important question for rhetoricians to determine is what cultural influences change children's minds and what role rhetoric has to play in that change. Has rhetoric
transformed our cultural discourse from a positive view of mathematics to a negative view of mathematics? Can this process be reversed?

I would argue that one reason our country is far behind many others is due in part to the narratives that we tell about mathematics. The comment, "But I'm no good in math," is unfortunately accurate for much of the American populace. The comment serves as a reflection of the culture from which it arises. Our narratives about mathematics illustrate the problems we have in this country learning and thinking about the subject. Far too many people are failing to comprehend mathematics in elementary and secondary schools. The problem, then, is at least in part rhetorical. Former NCTM president Frye said, "Too often in the past, families were willing to excuse failure in mathematics. There was a sense that 'I didn't learn it, so you don't have to either'" (in Ramsey F5). This has been reinforced from parents to children: there is a social dynamic that says it is acceptable not to do well in mathematics (A5).

In this sense, then, a rhetorical study of NCTM is warranted because the NCTM sees itself as the antidote to the problems of learning mathematics in this country. Many in the education and policy communities look to NCTM, the leading organization of mathematics educators, for a response to this cultural problem. The NCTM Standards are the response to mathematical innumeracy, and serve to establish
a new narrative about mathematics. Because the Standards are being taught to prospective mathematics teachers, and are featured in inservice sessions to current mathematics teachers, the Standards show signs of becoming an even greater part of our educational system. Thus, it is worth our time to study the Standards.

Given the role of the NCTM, I will use as my text for analysis those works which seek to remedy the cultural situation just outlined. I will use the three volume set of standards published by the National Council of Teachers of Mathematics as my primary text.

The method I will use to analyze the NCTM Standards is to look at the Standards as both movement and narrative. I have chosen this combination of approaches for two reasons. First, narrative relies on point of view, the relation between all facets of a communication transaction. Since mathematics is mediated by discourse, we must select a method that encompasses the ways in which discourse is viewed by a variety of people. Since people approach mathematics in a variety of ways, we can account for those differences through narrative. Additionally, since mathematics is highly symbolic, we need a method that accounts for the fact that people will represent a word, such as "subtraction," in multiple ways. Accordingly, the best method by which to analyze the Standards is one that combines the narrative and movement approaches.
My approach to narrative will include Susan Lanser's point of view. It is my intention to apply Lanser's work, which is based on fictional texts, to non-fictional texts such as the Standards. Lanser's work is appropriate because "It posits connections between narrative voice, and the material, social and psychological context of the writing act, connections between ideology and technique" (5).

I will also use the work of MacLean, who is also primarily a literary theorist. MacLean's theory rests on two key terms, the énoncé, the enunciated, and the énunciation, the saying or telling of a story. In MacLean's view, each story consists of both its past and a representation of past events in the present.

The reason for using MacLean is that the NCTM Standards rely so heavily on past work. To understand the NCTM Standards, one must go back to the new math and to the reform movements of the early 1980's. Therefore, a method that recognizes the past and its possible reinterpretations is called for.¹⁵

In addition, I will use narrative theory provided by Didier Coste as an organizing framework for MacLean and Lanser. Coste's conception of narrative is grounded in both literary theory and in communication, and thus, serves as a bridge over which my analysis can move.

My use of narrative in this way hopes to accomplish two purposes. First, the method can demonstrate that alternate
views of narrative can help us learn more about rhetorical texts. Additionally, the method should bring the use of narrative into the examination of mathematical texts, something that has not been previously accomplished.

I will not simply count the numbers or types of metaphors in this study. Rather, I seek to apply the notion of metaphor to the Burkean notion of the representative anecdote.

David Cratis Williams suggests the representative anecdote is act and form; "a theoretical construct, a statement of what a motivational complex is, and a methodological procedure, or a way of discovering the motivational complex" (in Masden 4). Hence, the representative anecdote is designed not to simply find the anecdote, but to demonstrate the motivations behind the discourse. This is particularly important, since this dissertation seeks to serve as a starting point for investigating the rhetoric of mathematics. Consequently, in order to fully understand the rhetoric of mathematics, I must find not only its theoretical construct, but its underlying motivations.

Brummett argues, "An anecdote is a narrative or dramatic form which the critic uses to order a perspective on the discourse" (3-4). He goes on to explain, "The anecdote need not have been said explicitly in the discourse under analysis. It is a method for better understanding the
vocabulary of utterances rather than an utterance itself" (4).

Therefore, to conduct a dramatistic analysis under the rubric of the representative anecdote, the critic looks at the discourse much like a play: "If this were a story or play, what would the bare bones or abstract outline of the story be, what is the plot and what pattern does it follow? who are the actors, are they fools, heroes, villains? what is the setting, what are the props, what kind of actions take place?" (Brummett 4) Thus, I will be examining the Standards through Brummett's suggestions in an effort to identify the important anecdotes in the Standards.

Additionally, I will examine the Standards as the representative text in the movement of mathematical education reform. Since the NCTM Standards is the precursor of other pedagogical movements, such as among history and English teachers, it is a movement worth considering.

The innovational movement, proposed by Ralph Smith and Russell Windes, deals with groups or organizations who try to conduct incremental change. As Smith and Windes note, the innovational movement "acts with the expectation that the changes it demands will not disturb the symbols and constraints of existing values" (143).

I will contrast the theory of innovational movements with the theory of transformational movements. The latter type of movement starts with the ideal of reform, and
progresses beyond reform. Burke asserts, reform implies simply forgiveness and a return to action: "If we say that a sinner 'reforms,' we mean that he simply gives up his sins and returns to the traditional norms of action" (Grammar 357). However, most reform movements must go beyond this level in order to gain converts and truly enact change. Reform works for the converted, but not for those who need to be converted to an alternative belief system.

Thus, we find that many movements go beyond reform and to the level of transformation. As Burke contends, "a transformation is a change in substance or principle, a qualitative shift in the nature of motivation" (Grammar 357). We can then speak of a revolutionary movement as one that engages in transformational rhetoric. The movement must undergo significant change and progress, not unlike Kuhn's notion of the paradigm shift. Kuhn's notion is valuable for us, as it highlights the belief that paradigms "gain their status because they are more successful than their competitors in solving a few problems that the group of practitioners has come to recognize as acute" (23). By considering the NCTM as a social movement, I hope to understand what we can learn about the NCTM specifically and about innovational movements in general.

Movements are always led by a leader who has the skills and ability to manage a group. Consequently, the final critical theory I will use is Thomas Lessl's notion of expert
rhetoric. Lessl is valuable because he highlights how expert
discourse such as scientific discourse or the NCTM Standards
is moderated by a leader who bridges the gap between
technical and lay audiences.

To illustrate how the method is being used, I will
select material from the first volume of the Standards. The
Standards, like any document, arise from a particular
rhetorical situation; it serves as a response. The NCTM is
not using the new math as the historical backdrop, but
rather, the NCTM cites the educational problems of the 1980's
as the justification for curricular reform. Thus, the NCTM
does not seek to correct new math; its aim is to respond to
the cultural critiques of American education in the 1980's.
Instead of citing new math as the problem, they turn to A
Nation at Risk, which was published in 1983. This énoncé
serves a rhetorical purpose: it allows the NCTM, who
published the Standards in 1989, to claim that they worked
quickly to bring about true reform in mathematics education.
If the story had been defined in terms of being a response to
new mathematics, the NCTM would not have had the advantage of
a speedy response. Furthermore, the NCTM sees itself as
responding more to future needs than past problems. The
story is not that past pedagogical theories have failed, but
rather, that economic reality has forced the NCTM to change
how it views mathematics education: "As society changes, so
must its schools" (5).
Every narrator chooses when to begin her or his story, and the NCTM's choice of the enunciated is significant. Starting the story in the early 1980's as opposed to the early 1960's helps the NCTM gain credibility for their standards. Moreover, their emphasis on the future and not the past helps their credibility as well. The enunciation of the story, then, is that the Standards is yet another modern solution to the problems facing mathematics education.

One of the key elements of the story is control. Learning outcomes will be improved in classrooms only when the Standards are adopted. There is a sense that the NCTM wants everyone to get involved: "Consider what needs to be done and what you can do, and collaborate with others for the benefit of our students, as well as for our social and economic future" (12). Interestingly, this appeal, which closes the introduction to the first volume of the Standards, sounds not unlike a political appeal. Not only is the element of control important, but we also find the notion of pathos--strong emotional appeals. The NCTM believes that only through strong, emotional commitment, where all teachers join together, can the Standards be adopted and educational reform would be successful. Their rhetoric is clearly a rhetoric of reform (255).

In Burkean terms, then, we have a clear villain: those who keep to the old ways of paper-and-pencil mathematics (254). The villain is strongly entrenched in the system,
because test scores have become a key predictor of school achievement. The only way of slaying the villain is through the Standards. The Standards, in this sense, serve as the outline for how the takeover will occur. It sets forth who will be in charge of the takeover, how students will be involved in the classroom, as well as how classrooms would look after the takeover.

Organization of Study:

In my second chapter, I will elucidate Lanser and Maclean's views of narrative, and integrate those views into a critical framework. I will also use the representative anecdote, and adapt its usage to mathematical discourse.

The following chapters will examine each individual volume of the Standards. The final chapter will evaluate the NCTM Standards and suggest future mathematics education reforms.

Notes:

1. This was true for a variety of philosophers, such as Kant, Descartes, and the like.


3. See also Philip J. Davis, "Fidelity in Mathematical Discourse: Is one and one Really Two?" American Mathematical Monthly 79.3 (1972): 252-263.

4. I recognize there are vast areas of mathematics in which no referent to reality is claimed. This approach is more classical. See Morris Kline, Mathematics and the
5. See David Pimm, *Speaking Mathematically: Communication in Mathematics Classrooms* (New York: Routledge and Kegan Paul, 1987). Interestingly, the NCTM Standards, especially the Curriculum and Evaluation Standards, make the same claim: "Mathematics can be thought of as a language that must be meaningful if students are to communicate mathematically and apply mathematics productively" (26). My point here is that mathematics is seen as a specific type of discourse, and hence, is subject to a rhetorical examination.

6. The terms "algebras" and "geometries" are not typographical errors. To track a satellite involves 6-dimension geometry. We can also speak of such phenomena as 7-dimension, 11-dimension and 26-dimension geometries, each with different properties and different axioms. See Thomas F. Banchoff, "Dimension" (in Lynn Arthur Steen, *On the Shoulders of Giants*, op. cit., pp. 44-46). Also, as one mathematics scholar notes, "Since 1826 innumerable useful geometries have been invented by mathematicians, either to serve definitive scientific or mathematical purposes, merely or for pure whim" (Bell 153-154).


9. Van Bendegem introduced the helpful notation of the "proof-outline" instead of the proof, where the proof-outline represents a sketch of what the ideal proof would look like. Unless otherwise stated, all future references to the word "proof" will be taken to mean "proof-outline."

10. This term has become a synonym for "mathematically anxious."

12. In addition to rhetoric's role in mathematics and science, one of the intellectual trends of the past 20 years has been to examine the role of rhetoric within different disciplines. A variety of disciplines, from economics, psychology, law, political science, history and so forth, have all turned to rhetoric to explain the transactions within their discipline. The entire movement has been labelled the rhetoric of inquiry, which was initially conceived as "the relationship of rhetoric to the epistemological and hermeneutical purposes of academic investigation" (Lyne "Rhetorics" 66). Accordingly, people involved with the Project of the Rhetoric of Inquiry seek to examine the role that rhetoric plays within academic endeavors. There has been increasing interest in rhetoric's application to the natural sciences, as shown in the work of such varied authors as Gross, Prelli, Zagacki and Lyne.

13. The history of mathematics is filled with major paradigm shifts. The first shift concerned the move away from integers to irrational numbers. Traditional arithmetic involves the integers; indeed, the only irrational number many students encounter before their high school geometry course is the number $\pi$. Much of everyday mathematics deals with counting numbers. However, there are other numbers; as Eves states, "It must have been a genuine mental shock for man to learn there are points on the number line not corresponding to any rational number" (Before 1650 44).

The first major crisis in mathematics was precipitated by the discovery of the right Pythagorean triangle with sides of 1, 1 and $\sqrt{2}$. Previously, only triangles with whole number sides had been found; such combinations included {3,4,5}, {6,8,10}, {5,12,13}, and so forth. The end result of this crisis was the "logical scandal," or the problem faced by the Pythagoreans. Their contention was that any two line segments are commensurable; that is, they have some common unit of measure (Eves Before 1650 53). For example, a line segment of length two and a line segment of length three have the line segment of one in common (i.e., $1 \times 2 = 2$, $1 \times 3 = 3$, and all of the numbers are rational). This also extended to language; competing explanations of events had commonalities. However, a line segment of length three and a line segment of length $\pi$ have no common length segment; there are no two rational numbers that multiply to equal $\pi$.

As a result, the Pythagoreans found a dilemma. The solution was offered by a Eudoxus, a student of Plato, in 370 B.C. (Eves Before 1650 54). Eudoxus' solution was to
shift the emphasis from Pythagorean studies of number to what we might term classical geometry (Hollingdale 21-22). The solution involved using proportions; Eudoxus defined ratios, which related magnitudes, and not necessarily numbers (Hollingdale 29-30). By implication, the discovery of numbers such as π forced the Greeks to face the concept that there was an infinite set of rational numbers (Boyer and Merzbach 103). The Greek language, then, was incomplete. No longer could a mathematical term be defined by a priori terms. In fact, the mathematical discovery of irrational numbers created new vocabulary; the Greeks began to use the word analogia to describe what we would call ratios instead of the word they had used, logos (Dunmore 214). As Dunmore concludes, "This is the story of perhaps the first great meta-level revolution in the development of mathematics" (215). The discovery of irrational numbers created a change in Grecian discourse. For example, the way in which proofs were conceived changed dramatically. This had an impact on rhetoric in the Greek courts. Rhetors used ratios instead of proofs, and the term analogia came to be used in the legal setting. A mathematical discovery had made a societal and rhetorical change.

The second historical sequence important in a rhetorical sense is the advent of non-Euclidean geometry. The significance of non-Euclidean geometry moved far beyond the mathematical knowledge; "In a sense, the discovery of non-Euclidean geometry dealt a devastating blow to Kantian philosophy comparable to the effect on Pythagorean thought resulting from the disclosure of incommensurable magnitudes" (Boyer and Merzbach 581). Non-Euclidean geometry was revolutionary; it was "inconsistent with the traditional view of Euclidean geometry. This is to say, it is a prerequisite for the creation of non-Euclidean geometry to break away from the traditional view of mathematics" (Zheng 173). Indeed, some argue that the creation of non-Euclidean geometry led to the beginnings of modern mathematics (Zheng 176).

The historical record concerning non-Euclidean geometry was characterized predominantly by silence and unclarified arguments. Indeed, there is doubt in the historical record as to whom was the first to develop non-Euclidean geometry. Jesuit priest Girolamo Saccheri tried, as did many others, to prove Euclid's fifth postulate, which can be summarized as "Through a given point can be drawn only one line parallel to a given line." The problem with Saccheri's proof is that it contained a contradiction. As Eves notes, "Had he not been so eager to exhibit a contradiction here, but rather, had admitted his inability to find one, Saccheri would today unquestionably be
credited with the history of non-Euclidean geometry" (An Introduction 126). Frederic Gauss did not publish his work, but rather elaborated the idea for himself, apparently because of the fear of ridicule (Hollingdale 332). Again, we see the role culture and rhetorical discourse play; because Gauss' work could not meet the rhetorical constraints operating within 17th century mathematics, the field of mathematics was not advanced.

Much of the history of mathematics suggests that non-Euclidean geometry was identified fairly simultaneously (Boyer and Merzbach 580). "It is notable that it was Lobachevsky and Bolyai, the two who had no reputation to risk, who published first. But it was only when Gauss, eminent and respected, added his name to the publicity that it began to be accepted" (Dunmore 213). Gauss initially refused to do so, claiming that the publicity would ruin his own career.

Both the philosophical and rhetorical implications of this move were significant. According to Eves, "Mathematics emerged as an arbitrary creation of the human mind and not as something essentially dictated to us of necessity by the world in which we live" (After 1650 80). As a result, discourse that described new mathematical forms, such as number theory, became necessary. Each new mathematical form required a rhetorical justification.

Changes in metamathematical views do take place; Euclid's inferences were long viewed as paradigms. As non-Euclidean geometry developed, there was a strong initial resistance to breaking the Euclidean paradigm. As a result, those who developed non-Euclidean geometry had higher standards of proof than mathematicians previously had to face (Kitcher Nature 224).


Jonathan Kozol cites a 1973 study that shows over 60% of people surveyed could not calculate the difference between prices for a new and a used appliance in advertisements. Additionally, over 40% could not determine the correct amount of change they should receive from a transaction. See Illiterate America (New York: Anchor Press/Doubleday, Inc., 1985).
CHAPTER 2
METHODOLOGY

Introduction of Narrative:

An appropriate method to study the NCTM Standards must take three factors into account. First, the Standards are a vision of what is valued in mathematics classrooms (Curriculum and Instruction 2). The Standards are a story presented by the NCTM which has visionary force. The Curriculum and Instruction Standards point out that the Standards are designed to be facilitators of reform (2). Since the text sees itself as a change in the status quo, we must account for its visionary qualities in our analysis. Second, as mentioned in the previous chapter, the NCTM Standards present a view of the history of mathematics education. By selecting historical events in the Standards, the NCTM has offered its own representation on the status of mathematics education in the 1970’s and 1980’s. This representation comes from a group that played a large role in that history. Accordingly, one can read the Standards as a historian’s reflection, with some autobiographical qualities. Thus, we understand the history from its participants as a rhetorical narrative. Finally, the Standards are representative of a rhetoric of change and reassessment within education. The NCTM sees itself at the forefront of change within mathematics education, and points to the
Standards and its accompanying addenda^2 as vital to the state of mathematics education. We must account for the Standards as part of a larger discourse. Accordingly, our method must address the representative nature of the Standards.

I will analyze the Standards primarily through narrative theory. The claim that discourse can be examined from a narrative perspective is far from novel^3; one needs only take a cursory glance at both the rhetorical and performance traditions to find a variety of studies using narrative. We take for granted the ability to use narrative as a method to study a variety of forms: campaign rhetoric^4, religious rhetoric^5, political rhetoric^6, literary works, and so forth. Indeed, narrative studies have been applied to the rhetoric of science as well. One of the important features of narrative is its adaptability to a variety of situations. It is my contention that narrative is an applicable method to study the rhetoric of mathematics as espoused in the NCTM Standards.

In this study, I take the following as my definition of narrative: "Narrative is a way of ordering and presenting a view of the world through a description of a situation involving characters, actions, and settings that change over time" (Foss 229). The narrator has some degree of control in how a worldview is represented in a text, but that ultimately, the narrator's perception is one of many attempts to offer order to a series of events. We study a text such
as the NCTM Standards as a dynamic, rather than a static force. Accordingly, a method such as Ernest Bormann's rhetorical vision is not entirely satisfactory. While Bormann does illustrate how a view of the world can be presented in terms of a unified rhetorical vision, Bormann does not explain well how different audiences gain different rhetorical visions from the same text. Additionally, Bormann's method is best for dealing with relatively small groups of people who begin the process of identifying the rhetorical vision. In the case of the NCTM Standards, there are too many authors involved to consider them as a unified whole. Instead, we see multiple authors creating multiple narratives.

This definition of narrative is superior for two major reasons. First, it does not rely on a chronological time sequence. Most narratives are not chronological, but shift in time to highlight specific events. Additionally, Foss' definition highlights the representative nature of rhetoric in general, and a work such as the Standards in particular. The Standards offer a view of what the mathematics classroom should look like, as well as the political factors that surround the classroom.

Foss' definition satisfies some theoretical objections about setting. Rhetorical scholars from Lloyd Bitzer to Kenneth Burke have emphasized the importance of setting. Every rhetorical text is grounded in setting. Accordingly,
our method must deal with the setting of the text, and how setting contributes to our understanding of the text. A narrative that does not consider the setting fails to tell the story adequately.

I will support my contention that narrative is an appropriate method to study the rhetoric of mathematics by examining several theoretical perspectives on narrative, including rhetorical and performance-based perspectives. I will then outline some of the critical features that must be included in any theory of narrative form. Finally, I will propose a narrative framework using the work of Susan Lanser and Marie Maclean that will answer the objections to previous work in narrative.

Within the rhetorical tradition, one of the more well-known essays on narrative is Walter Fisher's "The Narrative Paradigm." Fisher's essay has been subjected to rigorous critique in the literature, yet it still remains the basis by which many discussions of narratives begin. I will therefore begin my investigation of narrative with a brief examination of Fisher.

Fisher argues that narrative is a metaparadigm that subsumes all other theoretical paradigms. Humans are homo narrans, or story tellers. They create texts that are composed of "good reasons," or elements that act as warrants for accepting or validating a particular story. These
narratives can be found in interpersonal discourse as well as in public discourse, as opposed to intrapersonal discourse.

Often, we are told several different stories about the same subject. We then are placed in the role of adjudicator; which elements of which stories do we accept? Fisher contends that we decide which parts of a story to accept by its narrative fidelity, or how well a story coheres. To Fisher, narrative fidelity does not have to be strictly propositional, but instead, can be based on "good reasons" which do not fall under the rules of deductive logic.

The one aspect of Fisher that is important to our discussion is that Fisher contends that technical discourse falls in the perview of narrative theory. He claims that technical discourse is both myth and metaphor, and is not entirely *logos*.

The critiques of Fisher are numerous, and as Foss points out, are based on several issues. One of the distinctions Fisher sets out to prove is that there is a difference between "narrative rationality" and "traditional rationality." Fisher sees traditional rationality as deductive logic. For our purposes, most conceptions of mathematics fall under the traditional rationality paradigm. Narrative rationality is the more interesting case for Fisher. Critics such as Barbara Warnick, Michael McGee and John Nelson argue, however, that traditional rationality is partially included in narrative rationality, thus blurring
the distinction that Fisher states. In Warnick's view, to speak of traditional rationality must necessarily include narration. However, some of his critics have contended that narrative fidelity is ultimately based on traditional tests of logical soundness. Another major objection to Fisher is that his notion of narrative rationality is often descriptive rather than prescriptive and evaluative. As Scott and others suggest, rhetorical criticism needs to make clearer the suggestions between narrative forms and rhetorical functions.

While several theorists have embraced Fisher and his work, many have turned to other forms of narrative. Scholars such as Dwight Conquergood have taken "the performance turn" in narrative theory. Conquergood posits the homo performans, the human as performer. The homo performans invents culture and self while telling stories. The performer is not confined to a chronological telling of the story, but rather, can juxtapose elements of the story in any order. Performance, then, becomes a lens by which we can conduct research. In the performance paradigm, process is more important than the end product.

Conquergood, Mary Frances HopKins, and other performance theorists often draw from a rich literary tradition of narrative. Such theorists as Mikhail Bahktin, Wayne Booth, Susan Lanser, and Mary Louise Pratt all espouse a literary
perspective. These theorists, trained in literary criticism, often use fictional texts as their objects of study.\textsuperscript{11}

I contend that not only can we extend the literary tradition of narrative to nonfictional texts such as the NCTM Standards, but we are compelled to do so. Booth argues all types of stories fall under the rhetoric of narration, and that the lines between stories as art and stories as "something else" have blurred considerably (\textit{Rhetoric of Fiction} 407). Indeed, the language of the teacher is a narrative genre of its own (Bahktin \textit{Dialogic} 289).

We receive messages as tales. We treat a text, whether it be Shakespeare or Darwin, as a tale that involves the reader in its telling. The audience listens to the tale critically, receiving and judging the variations in style, in voice, and in rhetorical savoir-faire provided by the performance (Maclean 7). The degree to which a tale captures our imagination is explained in part by the audience's judgment of the narrative.

According to Maclean, the audience judges actively, providing feedback on the narrative's effectiveness. The performance generally works on shared expectations; for example, we expect a Harlequin romance to have a happy ending. Maclean's idea is that power is granted to the hearers and the teller based on cultural norms and guides. (7).
Within the literary tradition, characters as well as characterization are important to understanding the story. Within a rhetorical paradigm, characterization is one means of illuminating a text. Taken in the purview of performance narrative, we need to know more about how our narrators act in order to understand the performances they give. In other words, to fully understand the NCTM Standards, one must investigate the role of the NCTM.

In the literary/performance perspective, we must be very careful to define our terms, as traditional terms such as point of view, setting, and so forth have taken myriad meanings. One of the most discussed devices is point of view. Susan Lanser sees point of view as an important theoretical construct as well as a literary device. Lanser sees point of view as a "complex relationship between sender(s), receiver(s), perceptions, words, and the circumstances of communication--is governed by a network of material, social, psychological, and linguistic constraints" (4). Point of view, then, takes on literary, rhetorical, and sociological considerations. To understand point of view is to identify the ideological and sociological forces that are a part of the communicative situation.

Lanser believes the critic fulfills specific functions. First, the critic confronts the conventions for narrative structures which operated in the socioliterary environment in the text's creation and the conventions that operate within
the text today. In other words, the critic must note the persuasive features of the narrative historically and in the present, and must juxtapose the two time frames. To understand a work such as the Standards requires an understanding of mathematics education in the late 1980's as well as in 1995.

Second, the critic has to confront the complex psychosocial dynamic between the writer and the writer's audience, and the historical realities which have produced these dynamics. The writer does not write apart from an audience, but with a clear awareness of audience. The critic must make the connections between the text and the audience's expectations and responses to the text.

Finally, the critic must recognize a narrative's intertextuality. The text has a specific narrative perspective and voice in relation to all other texts. Thus, the critic must not only find the texts that interact with a given text, but also understand how each text informs the other.

Lanser's critical perspective not only examines point of view, but also includes an examination of the role of the narrator. In Lanser's critical vocabulary, the narrator has status, contact, and stance. As she notes, "Each is the product of social realities which in some sense 'precede' the production of discourse, and each is manifest in the textual point of view" (86).
Status refers to a narrator's relationship with the speech act; in other words, the authority, competence and credibility the communicator is allowed personally and conventionally (Lanser 86). Status is made of identity, credibility, sincerity and skill. We identify the terms of status within a particular linguistic community; for our purposes, we look first to the mathematical education community, and then ultimately to the public at large who is urged to participate in the Standards.

Contact simply relates to the extent a speaker establishes a bond with her or his audience. As Lanser notes, "the relationship between speaker and receiver (or the speaker's conception of that relationship) is reflected in the speech act itself" (91). Lanser defines this contact in both physical and psychological terms. The psychological nature of contact can be defined within the text, or can be implicitly derived.

Finally, the speaker has a stance with regard to a text, or a relationship to the message being produced. Lanser states, "the way in which a message is received and understood is considerably dependent on the way the stance is presented and the relationship of that perspective to the reader's own" (92-93). Stance ultimately turns to both ideological and psychological attitudes toward a particular discourse, both on the author's and audience's part. These attitudes are important in the sense that stance will help
determine the audience's emotional and ideological response to a text (93).

Lanser notes that status, contact and stance are intertwined and must all be within conventions of acceptability for a particular discourse situation (94-95). In other words, the narrative suggests particular ways in which status, contact and stance are to be addressed. A narrative of change must somehow engender a bond between the reader and the teller, and that the reader must be compelled to engage in different behaviors. The story must be considered tellable, but can be delivered in a variety of ways (96-97).

Lanser's work suggests that the critic needs to look at the intertextuality that exists between two texts. MacLean refines Lanser's work by examining the 'gaps' or 'blanks' in the narrative sequence that triggers the hearers' imagination. These gaps enable the reader to help structure the narrative. We notice what is in a story as well as what is not in the story. To examine intertextuality is to notice absence as well as presence.

Maclean also points out that there is a variety of types of audiences. One of these audiences is the ideal reader, who is totally aware of narrative strategies, how context and intertextuality work, and has great insight into the author's own thought process (91). However, she notes that most
readers fail this criterion, and instead, fit into one of the other audience types.

The audience can be either implicitly or explicitly addressed in the narrative. Maclean notes that the narrative audience must be granted ideological, literary and historical context while also seeing the audience as confined to and by the world of the tale (90). Also, though, there is an audience of the énonciation, where the reader responds to the processes of narrative and the narrative's textual strategies; in other words, the audience is of the telling rather than the tale (91). On this level, style and rhetoric operate.

**Toward a Conception of Narrative:**

As Maclean notes, a story must obey the basic conditions of narrative (73). At its most basic level, I define narrative as a story that has an introduction or orientation, moves to complicate or clarify the introduction, and resolves or confuses the listener at the end. Every story must have a beginning that informs the reader as to the parameters of the discussion. This introduction should suggest that the story has a point, although the point the audience initially perceives and the true point of the story can be different (Maclean 73). If the story is not complicated in some way, the audience has no motivation to listen. There must be something different that the audience has not heard before
that compels the audience to read or hear the narrative. Finally, the story must have some kind of ending. The ending can be designed to either resolve tension or create new tension.

My conception of the narrative is also concerned with énonciation, or the "textual strategies of the speaking and organizing subject" (Maclean 83). Clearly, a narrator has a variety of means to highlight and expand her or his message. As rhetoricians, we are interested in how the NCTM uses rhetoric, in this case, the structural and stylistic devices of narrative, to not only enhance acceptance of the Standards, but also to communicate mathematically. Accordingly, narrative is not just about story but how the story is told. The narrative arises from a particular viewpoint or ideology. One of the critic's tasks is to investigate not only the text's viewpoint, but how rhetoric helps create that viewpoint.

Finally, my conception of narrative takes into account intertextuality. We must not only read the story, but find out what is missing from its telling. What characters and plot elements are left out? How do omissions affect the narrative? Chapter 6 will be devoted to examining the three volumes of the Standards as a whole to investigate their intertextuality as a complete set.

Narrative theory serves as a starting point in the examination of the rhetoric of mathematics. Traditional
narrative theory, has focused on the *telling* of a story. Contemporary narrative theory, however, examines the text's polysemy, or potential for multiple interpretations.\(^{12}\) The difference is that contemporary narrative theory allows us to weave multiple stories into a single narrative structure.\(^{13}\)

Narrative theory is best at explaining how a story was produced and *describes* this process. In order to answer rhetorical questions at the level of critical perspective, we must refine our method so that it explains rather than describes what takes place. Accordingly, we must use a framework which provides us with tools to analyze a rhetorical situation. Specifically, the framework must allow us to make the rhetorical judgments that narrative suggests *can* be made about a text. This is why I have chosen to supplement narrative theory with the "representative anecdote," originally offered by Kenneth Burke.

**Taking a Part of the Representative Anecdote:**

The representative anecdote is a selection in the realm of action. As David Cratis Williams points out, the representative anecdote is act and form. The representative anecdote is both a "statement of a motivational complex and a methodological procedure of discovering the motivational complex" (in Masden 209). Burke sees the representative anecdote as necessary in the study of human relations, and is "so dramatic a conception that we might call it the dramatic
approach to dramatism" (*Grammar* 60). Thus, the anecdote both tells us about the motives behind a story, as well as how to discover those motives.

Brummett notes, "An anecdote is a narrative or dramatic form which the critic uses to order a perspective on the discourse" (3-4). The representative anecdote does not actually have to be in discourse. Rather, the representative anecdote "is a method for better understanding the vocabulary of utterances rather than an utterance itself" (Brummett 4).

Williams suggests that there are two different types of representative anecdotes: admonitory and constitutive (198-199). Admonitory anecdotes tell an audience about what they are "in danger of becoming" (*Grammar* 330). The admonitory anecdote is used in cases of warning or chastisement; the reader is told what should not be done. While this type of anecdote is important, it is not suitable for our purposes. Admonitory anecdotes do not take into account the fact that the NCTM set forth an agenda, and focused on what should be done instead of assessing blame.

This forces us to consider the constitutive anecdote. The constitutive anecdote reveals indices to mankind's ontological nature, and will be the type of anecdote that concerns us in the dissertation (Williams 199). As Burke argues, constitutive anecdotes point to "what is" instead of what might be (*Grammar* 330-332). It is the move from description to ontology that makes the representative
anecdote significant. Burke adds an additional type of anecdote, the informative anecdote. The importance of the informative anecdote to this project is related by Bozerman, who suggests that professional standards play a role in determining which informative anecdotes are acceptable. The informative anecdote is "an entrance into the analysis of human motivations" (Burke Grammar 510). The informative anecdote as a series of selections in a text has a reductive character, which he labels as both simplificatory and genius. In Burke's view, it is necessary to translate ideas from high to low levels of complexity. the scientific rhetor "next proceeds to transfer ('to metaphor') this terminology to the interpretation of a different order of cases" (Burke Grammar 510).

Accordingly, to conduct a dramatistic analysis under the rubric of the representative anecdote, the critic begins by looking at the discourse much like a play: "If this were a story or play, what would the bare bones or abstract outline of the story be, what is the plot and what pattern does it follow? Who are the actors, are they fools, heroes, villains? What is the setting, what are the props, what kind of actions take place?" (Brummett 4) Brummett claims, "The dramatic form in discourse is the 'hub' from which other motives radiate" (3). The representative anecdote is a dramatic form that underlies and represents a discourse.
Brummett's view of the representative anecdote has its critics. Arnie Masden argues that Brumett's scheme fails to provide us with the means to test its conclusions, and that Brumett's conception is tautological. Madsen contends that many different discourses could fit Brumett's criteria, and suggests that a proper anecdote must reflect human action, possess adequate scope, and represent the text in its entirety (Masden 213). Masden's complaint is that Brumett has only satisfied the "adequate scope" criteria.

I contend that the representative anecdote is an introductory means by which we can highlight the important players in a story, as well as to begin speculation as to why those players are part of the narrative. Ultimately, the representative anecdote serves as an introductory form by which the analysis should be shaped (Burke Grammar 324). This introductory form comes from the text, not from the critic (Masden 210). Accordingly, we start with the text, and then draw larger conclusions based on a text's interaction with other texts, as well as with the world at large. In Chapter 5, the Assessment Standards will be viewed not only as a text, but also in relation to the previous two volumes of the Standards.

The Need to Represent More Than the Anecdote:

If indeed Brumett's portrayal of the representative anecdote is representative of what Burke had in mind, then
the representative anecdote simply tells us the outline of the story and fails to demonstrate the importance of the story. In that sense, it suffers from the same basic weakness as narrative theory. The representative anecdote turns into a thematic analysis without any grounding as to why themes are important. In Burke's own work, the representative anecdote is a starting point for analysis. The representative anecdote involves identifying the hierarchy within the text, as well as the examination of critical points in the text (Masden 214).

However, the anecdote can shift, even between volumes of a set, or within a movement. Thus, the anecdote is best suited as "a corrective to the critic's own analysis" (Masden 225).

As we investigate the NCTM Standards, we must acknowledge the fact that there are multiple audiences and multiple readers of the text. Each brings their own perceptual schema to the text. What seems obvious to a person in the classroom is not to a university researcher. This explains Booth's point that "there is a surprising amount of commentary directed to reinforcing values which most readers, one would think, already take for granted" (177). This analysis will attempt to take little for granted and demonstrate how multiple audiences influence and are influenced by the text.
Ultimately, we will investigate the NCTM Standards as a language system. As Bakhtin notes, "The transcription of thinking in the human sciences is always the transcription of a special kind of dialogue: the complex interrelations between the text and the created, framing context" (Speech Genres 106). The following three chapters, then, utilize Bakhtin's idea by examining the tensions between text and context within the parameters of the NCTM Standards.

In short, this analysis, will look at each of the three volumes of the Standards in an effort to uncover its textual strategy, and investigate how that strategy illuminates the rhetoric of mathematics.

Notes:

1. Throughout this document, I will refer to the Standards as the three-volume set. If I am referring to a specific volume, it will be identified; i.e., Curriculum and Evaluation Standards.

2. The Addenda are an approximately 20 volume set that refines and further illustrates the Standards by offering exercises, lesson plans, etc.


9. See Rowland, previously cited.


11. This should be pointed out as one of the limitations of the study: it attempts to use theoretical models based on fictional works to study non-fictional events. However, as HopKins and Wayne Booth have noted, these particular narrative perspectives can and should be used to study public discourse.

12. See Mikhail Bakhtin, The Dialogic Imagination (Austin: University of Texas, 1981.)


16. Burke would probably say, "It's more complicated than that!" However, he would also point toward Rhetoric of Motives, which uses the representative anecdote as a jumping off point into deeper analysis.
CHAPTER 3
CURRICULUM AND EVALUATION STANDARDS

Introduction: Reform before the Standards

To understand the reforms of the NCTM Standards, we must take a historical perspective that highlights pedagogical theory before its publication. By 1965, many teachers and parents reacted angrily to the "new math," and called for drastic curricular change. One of the major problems of "new math" was that it was unevenly implemented (Everybody 78). As test scores dropped, many in the mathematics education community began looking for a greater sense of focus and direction (Hill 1).

Indeed, the public began to insist that something be done about the drop in test scores. Former NCTM president Stephen Willoughby noted that people were indifferent to mathematics and that "public opinion held that throwing money at education, particularly math education, was not proving successful in making America stronger educationally" ("Past-Presidential" 9).

As a result of the public outcry, many classrooms turned to a "skills and drills" model. In other words, students were forced to do worksheets as well as long series of computational problems. An NCTM study of the early 1980’s concluded "that elementary school mathematics was primarily devoted to helping children learn to compute" (3). The basic
skills model held that performance could be enhanced by having students do many problems of the same type (Osborne and Kasten 23).

The National Council of Teachers of Mathematics, as well as the National Council of Supervisors of Mathematics, both felt the need to respond to what many mathematics educators termed "extreme public pressure to narrow the definition of the 'basics' in school mathematics" (Hill 2; Crosswhite 455). The move toward "basics" became identified in public consciousness with computational excellence, such as students being able to recite their "times tables." Mathematics educators saw the problem with the back to basics movement as being unsure what "back to basics" really meant (Cooney 353). As the NCTM defined the problem, the major fault of the new mathematics curriculum was its lack of attention to problem solving (Osborne and Kasten 24-25). The result of the NCTM and the NCSM's collaboration was the Agenda for Action. This chapter will begin with an examination of the Agenda for Action, and will be followed by an investigation of the philosophical assumptions of the Standards.

In this chapter, I claim that the NCTM Curriculum and Educational Standards did not fully succeed in its stated goal of engaging educational reform. Simply put, the NCTM tried to be both a transformational movement and an innovational movement, and subsequently found itself confronted with a rhetorical paradox.
I will support my claim that the NCTM is neither a transformational nor an innovational movement by first, introducing the concept of movements and show how the NCTM is caught in a "rhetorical paradox." I will then review the Agenda for Action, as it is critical to understanding the historical context of the C&E Standards. Finally, I will also examine the underlying philosophies of the C&E Standards, as well as the appeals made by the C&E Standards.

Innovational Movements and Transformational Movements:

Movements have traditionally referred to any group seeking social change through collective action. As we mentioned in chapter one, we must consider transformational and innovational movements.

Transformational movements start with the ideal of reform, and aim for fundamental changes. For example, many social protest movements are transformational in nature. We can then speak of a revolutionary movement as one that engages in transformational rhetoric. Social protest movements such as Earth First are good examples of transformational movements.

The innovational movement deals with groups or organizations who try to conduct incremental change. Smith and Windes suggest an innovational movement will use two strategies in pursuit of its goal: spokesmen will deny any conflict between the innovation and society, and the movement
will emphasize the strength of traditional values at the expense of traditional institutions (143).

We then can speak of movements as a range from transformational to innovational. It is entirely possible for a movement to have both transformational and innovational characteristics. A movement that has important characteristics of both is caught in a dilemma; should the movement become radical, or should it seek progressive change? When the movement has an underlying tension characterized by this particular question, it is confronted with a rhetorical paradox. Simply put, a rhetorical paradox occurs when a movement is faced with the decision to become either innovational or transformational, but neither direction completely satisfies members of the movement.

Before we can understand how the NCTM Standards find themselves in this rhetorical paradox, we must understand the precursor of the Standards: the Agenda for Action.

The Agenda for Action: A First Response in the Early 1980's:

The Agenda for Action was intended to be a "message from teachers, not to teachers" (Hill 4). In fact, the NCTM saw the Agenda for Action as the mathematics education community's response to the problems of the 1970's:

"We recognize as valid and legitimate the role of public opinion in the determination of educational goals. But this philosophy is predicated on a well-informed public. Thus, the NCTM as an organization of professional educators, has a special obligation to present its responsible and
knowledgeable viewpoint of the directions mathematics programs should be taking in the 1980's" (Agenda 1).

In the Agenda for Action, we see the beginnings of the NCTM's belief as the voice of authority for mathematics education. This particular statement, which has become important to the NCTM's rhetoric, certainly calls to mind two contrasting rhetorics: elitist, technical rhetoric, and fundamentalist rhetoric. The next sections will develop these ideas.

The NCTM's statements attempt to build the *ethos* of expertise by attempting to move beyond the discipline of mathematics education into the political sphere. This move, as Lyne and Howe suggest, adds extra responsibility for the rhetor. As they note, the fact that the NCTM is the "expert" in mathematics education allows the organization some credibility in the political sphere. Lyne and Howe argue that the transferral of expertise works most effectively from a scientist; because the scientist has a high degree of source credibility, we are likely to transfer that credibility to other areas. The NCTM has a more difficult rhetorical task. Their job is more challenging because politicians and laypeople do not necessarily believe that educators know what is best for school districts. The NCTM is not able to claim the same type of expertise as Carl Sagan or Stephen J. Gould might; rather, the NCTM must turn to another type of appeal.
The type of appeal the NCTM ultimately adopts is a missionary rhetoric that functions by converting people to a particular point of view. In the case of the C&E Standards, one of the themes that arise from the NCTM’s statement is that of fundamentalism—in other words, the NCTM is the evangelizing force for mathematics education. Evangelical rhetoric has both unifying and disengaging characteristics. The NCTM sees itself as the leader in mathematics education, as well as pedagogical practices applicable to other disciplines. The NCTM Standards, for example, call for cooperative learning, classrooms where the student is no longer seen as subservient to the teacher, and where interdisciplinary learning takes place. All of these moves seek to establish the NCTM as the leader of reform in educational practice.

The NCTM offers a binary opposition in the Agenda for Action. Those who subscribe to the NCTM’s notion are “born-again,” and thus claim the right to speak. Those who have not been born-again cannot claim prophecy, and thus lose the ability to speak in a public forum.

The Agenda for Action was composed of eight recommendations for school mathematics, each of which was given a high priority (Osborne and Kasten 21). I mention these in turn because of their similarity to the Curriculum and Evaluation Standards.
The first recommendation was to make problem solving the focus of school mathematics in the 1990's. The belief was that computational skills needed to be separate from their application (*Agenda 2*). By the same token, basic skills were to include more than computational ability. In fact, the *Agenda for Action* cited the National Council of Supervisors of Mathematics, who suggested there are ten basic skills in mathematics (6-7).  

Another recommendation was that calculators and computers were also to be an integral part of mathematics education. The *Agenda* also called for computer literacy courses for each student and teacher (10). While the research supporting the use of calculators in the classroom was generally not available in the early 1980's, later studies have indicated that calculators are of some benefit (Bitter and Hatfield). The *Agenda* called for students to have "access to calculators and increasingly to computers throughout their school mathematics program" (9). Additionally, junior high schools and high schools were to have computer literacy courses (9). High schools were designed to provide background for computer science classes (10).  

The NCTM *Standards* do not really challenge this recommendation. The *Standards* call for calculators and computers in every classroom that should be available to students at all times. As the *C&E Standards* note,
"Calculators should be used to solve problems that require tedious calculations" (45).

The Agenda also recommended that stringent standards of effectiveness and efficiency be applied to mathematics education. The Agenda asked that elementary school teachers spend more time on mathematics and that time spent on basic skills be reduced and time spent on problem solving be increased (12).

Evaluation of programs was to move beyond conventional testing. The Agenda strongly criticized programs that relied solely on test scores, and called for new tests that would properly evaluate problem solving.

The sixth recommendation was that more mathematics should be required for students with more options available. The problem was that only one year of mathematics was required. The Agenda sought to eliminate tracking students and to require three years of mathematics for every high school student. Further, calculus was to be reevaluated as the touchstone course in high schools (21).

The seventh recommendation was that mathematics teachers should also demand a high level of professionalism of themselves. The belief was that teachers were not sufficiently demanding of themselves or their peers. In other words, teachers were to join professional associations such as the NCTM, and that mathematics programs were to be staffed by certified mathematics teachers.
The final recommendation of the Agenda for Action was that public support of mathematics instruction must improve. Society had to find ways of preventing the drain of qualified mathematics teachers. In addition, parents were also held responsible for having students do their homework and take a more active role in their child's education (28). On the other hand, some of the recommendations, especially those calling for incorporating technology into classrooms, have largely come to pass. Also, the emphasis the Agenda places on problem solving has been implemented in many classrooms. In summation, Osborne and Kasten found that many teachers, especially at the elementary school level, had not incorporated the Agenda's greater emphasis on basic skills. They had simply not reevaluated their beliefs about what was important in mathematics (27).

The Philosophical Beginnings of the Standards:

During 1983, there were again calls for reform in the education community, in texts such as A Nation at Risk. The report chastised the K-12 community for poor test scores and suggested a great overhaul of classrooms at both the elementary and secondary level. In particular, the report called for greater emphasis on mathematics and science. The NCTM felt compelled to respond to the criticisms of A Nation at Risk. The NCTM's response was to hold two conferences in 1983, each suggesting that a "new content framework" needed
to be developed for mathematics education in grades K-14 (Romberg 36).

Texts are written in response to situations. The Curriculum and Evaluation Standards are a response to the back-to-basics movement of the 1970’s and serve to expand the Agenda for Action. The NCTM believed that the back-to-basics movement was pointing mathematics pedagogy in the wrong direction, and so sought to correct that turn. The NCTM sponsored a series of conferences that became the basis for the Curriculum and Evaluation Standards. The ideological viewpoint of the conferences is best summed up by NCTM President Shirley Frye: "The curriculum of yesterday served the needs of the industrial age. The curriculum of today and tomorrow must serve the needs of the information age" (Innerst F3). The C&E Standards, then, were designed to meet Frye’s criteria by establishing what the curriculum of today should be.

The Standards were "written deliberately to be a political document based on a consistent philosophical perspective about mathematics" (Romberg 467). As the NCTM’s own literature indicates, the C&E Standards "tells what needs to be taught in school" ("For Educational Leaders" 3).

A part of the Standards political agenda was to open public dialogue about mathematics education ("Past-Presidential" December 8). The dialogue was to take place not just in the mathematics education community, but between
mathematics teachers, supervisors, and interested members of the public.

The Standards: General Goals

The Standards were designed to be ongoing efforts at reform; as Frye noted, they could take up to ten years to become reality (Innerst F3). In fact, the NCTM believed that the Standards would "have a pervasive effect on mathematics education during the next five to ten years" (Thompson and Rathmell 348). The Standards have at their core five goals for students in kindergarten through twelfth grade. First, students should learn to value mathematics. They are to appreciate the role of mathematics in the development in society and be able to explore and identify relationships between mathematics and other disciplines.

Secondly, students are to become confident in their ability to do mathematics. As the text notes, "To some extent, everybody is a mathematician, and does mathematics consciously" (6). This statement is important to understanding the Standards because most laypeople would disagree with the statement, while most mathematics educators would support it. Since students' and teachers' perceptions of the utility of mathematics are so different, "School mathematics must endow all students with a realization that doing mathematics is a common human activity" (6).
The third goal of the Standards is that students should become mathematical problem solvers. Interestingly, the text cites An Agenda for Action and argues that problem solving must be the focus of student work in mathematics. The types of problems students should expect are different, though, with more open-ended problems and more problems that take longer to solve.

The Standards were also designed to help students communicate mathematically. Students have to "use the language of mathematics" until it becomes natural (6). Finally, students should be able to reason mathematically. As the Standards note, "a demonstration of good reasoning should be rewarded even more than students' ability to find correct answers" (6).

The curriculum portion of the Standards is divided into three age groups: kindergarten through fourth grade, fifth through eighth grade, ninth through twelfth grade, and evaluation standards. At the end of the volume are evaluation standards. The NCTM suggests that there should be preschool and postsecondary standards as well, although they were not developed in the Curriculum and Evaluation Standards (6-7). Each standard also includes a series of expected student activities associated with doing mathematics (9).

At each level of the curriculum standards, four standards remain the same: problem solving, communication, reasoning, and mathematical connections (11). These are the
general standards that permeate all of the grade levels. In addition, there are content standards that vary for each curricular level.

The Rhetorical Appeals of the Curriculum and Evaluation Standards:

The Curriculum and Evaluation Standards is the cornerstone of a series of materials the NCTM has published to advocate the use of the Standards. Since this chapter primarily relates to the C&E Standards, I will focus on that text. Additionally, the NCTM has published other materials, including four different brochures entitled "A New Vision of School Mathematics," each targeted to a different audience, as well as a videotape entitled "Mathematics: Making the Connection," which stars Geoffrey Owens of the "Cosby Show," along with Wynton Marsalis and others. The NCTM has also published a series of transparencies usable by educational leaders, as well as the Communications Handbook, which is designed to help spread the NCTM's message to various media. When relevant, I will include samples from each of these different supplemental materials.

In order to understand the appeals of the C&E Standards, we must first identify the audience—in other words, who should read the C&E Standards? The NCTM identifies four different audiences, which serve as a starting point for our analysis: teachers, curriculum specialists, the public, and business leaders.
Teachers: Making NCTM's Reforms Reality:

Clearly, the major audience of the C&E Standards is teachers. The NCTM had a potential audience of nearly 1.8 million teachers at both the elementary and secondary level. With a group this large, we must clarify the important audiences present within the teaching community.

Cooney suggests that there are three different kinds of teachers, each filtering the Standards in different ways. To say that teachers' conceptions about mathematics are based on their own experience is to say nothing new. Cooney argues that teachers' experience tends to manifest itself in three different pedagogical viewpoints: instrumental, subjective, and fundamental (356). Each audience brings important presuppositions to the text that we must consider, and we will look at each type of teacher in turn. By understanding different audiences of teachers, we can see how the Standards was created and intended to be interpreted.

Cooney's first type of teacher, the instrumental teacher, follows the textbook to the letter. For this type of teacher, learning comes in identifiable sequences. This is the crucial case as far as the C&E Standards are concerned: much of its rhetoric repudiates this type of teacher. In the words of Burke, the instrumental teacher is the scapegoat. The Standards are concerned with the instrumental teacher as its idealized reader, for the
Standards claim to be for all teachers, and not just those predisposed to accept the assumptions of the Standards.

The second type of teacher, the subjective teacher, conducts an analysis of the material and then elaborates on the material based on personal knowledge. The C&E Standards mention little of this type of teacher, but tries to move the teacher into the fundamental type.

The final type of teacher, the fundamental teacher, analyzes the curriculum as well as the underlying philosophy of mathematics education. Most of the authors of the Standards are fundamental teachers and tend to question the underlying assumptions of their teaching.

One important philosophical issue that has to be resolved is how the C&E Standards entices other types of teachers to read. In other words, what would make an instrumental teacher want to reevaluate her or his philosophy to fall in line with the fundamental narrator of the Standards? One of the issues Cooney recognizes is that a teacher who changes from one type to another makes a dramatic change. Also, the students have to undergo change: as Cooney notes, "students gravitate toward a mechanistic curriculum and appreciate teachers whose interpretations of the text are quite predictable" (359). Indeed, the C&E Standards argue that "children develop a point of view about what it means to learn mathematics and solve problems in mathematics" (25). Thus, the C&E Standards already has to
overcome resistance from both teachers and students: while students may want teachers to be more interesting, students really want traditional teachers. The National Association of Educational Progress Survey showed little change in teacher methods of learning; in other words, students were subjected to the same methods of instruction as they had before. One of the strands the C&E Standards must answer, then, is how to effect change in a system that seemingly rewards the status quo.

One of the other factors that the NCTM must attack in the instrumental teacher's pedagogical style is the dominance of the teacher's communication. If the C&E Standards are to succeed, they must convince the instrumental teacher to decenter himself or herself as an authority figure. We find the decentering of the teacher in the rhetoric of the C&E Standards. The C&E Standards encourage children to make use of what it calls "informal narratives." The second standard, "Mathematics as Communication," suggests that children discuss problems in small groups in an effort to make sense of problems. At this level, the narratives may not be complete--young children often have an "inability to communicate" (27). In addition, children are also encouraged to "create their own stories or books about mathematics (emphasis added)" (28). Thus, narratives are encouraged for young children. Within a space of less than five pages, the instrumental teaching style is decentered and devalued twice.
The C&E Standards do respond to the issues Cooney raised. The first place the instrumental teacher is attacked is in the K-4 standards. Historically, much of K-4 mathematics education has been designed to teach students rules and operations, especially through rote learning (i.e., multiplication tables). The Standards tells teachers that understanding techniques is no longer enough; they attempt to move beyond the memorization of procedures and paper and pencil tasks. Again, early in the C&E Standards we find instances of where the instrumental teacher is criticized. The C&E Standards suggest that a student-centered classroom is more desirable than a teacher-oriented (e.g., an instrumental teacher) classroom. In order to complete the move from the teacher-centered classroom to the student-centered classroom, the students must ultimately take responsibility for problems, something the C&E Standards encourages by letting students create their own problems (24-25).

The instrumental teacher is further assailed in the 5-8 standards, where students are urged to turn away from outside authorities such as the teacher (71). The same idea is reiterated in the 9-12 standards, which call for decreased attention to the teacher and the textbook as exclusive sources of knowledge (129).

Criticisms of the instrumental teacher occur throughout the C&E Standards, but come to a conclusion in the last of
the evaluation standards, instruction. The importance of placing this point at the end of the text is fairly obvious; it is the hope of the designers of the C&E Standards that an instrumental teacher will recognize her or his mistakes and use the instruction standard to modify her or his teaching. Statements such as "Teachers must be willing to entertain suggestions from students and suspend judgment about their ideas" are the logical conclusion to the recommendations made in previous chapters of the text (245).

Instrumental teachers are made scapegoats in a second, more subtle way. The instrumental teacher believes that students should master a certain core of basic skills. For example, students should end sixth grade with the ability to work with fractions, to handle long multiplication and division, and to deal with percentages. The C&E Standards redefine basic skills for students in a completely incompatible manner, yet in a manner that attempts to reassure the instrumental teacher. The traditional paradigm assumes that students must know how to perform certain algorithms before solving word problems. The C&E Standards suggest the opposite approach--"knowledge should emerge from experience with problems" (9).

For example, the 5-8 standards address the topic of fractions. Instead of demanding proficiency, the 5-8 standards argue that "in probability, students have many opportunities to add and multiply fractions" (66). The
juxtaposition is important. Probability is a topic some teachers would like to see introduced in the 5-8 curriculum. By linking the desirable topic of probability with the necessity to teach fractions, the Standards authors are trying to increase the C&E Standards' acceptance. The C&E Standards is trying to reassure the instrumental teacher that fractions will be covered--they will simply be covered in a different portion of the curriculum. This is a strategy that the NCTM uses consistently in the C&E Standards.

The reason for these juxtapositions is twofold. First, the NCTM is arguing for a great shift in philosophy, from a traditional curriculum to a situation-based, integrated curriculum. Additionally, these juxtapositions lay the groundwork for a more profound shift in the way in which teachers orient themselves to their practices. The ultimate goal, of course, is that instrumental teachers should join the "hundreds of teachers and other mathematics educators" who "are eager to change school mathematics" (251). In order for the instrumental teacher to become part of the reform movement, a complete alteration in thinking--pedagogical and conceptual--is necessary. "The Standards is based on a set of values, or philosophical positions, about mathematics for students and the way instruction should proceed" (254). The impact of this shift will be addressed in the discussion of parents as audience.
The *Standards* as Reform Guide for Curriculum Specialists:

We have already examined the role of the first major audience of the *Standards*: teachers. However, the *Standards* was meant to address other audiences, the second of which is curriculum specialists, especially at the state level. Curriculum specialists help to decide what each state will require of its districts, as well as select the textbooks that can be purchased by public school districts. Given that the *C&E Standards* are meant to be adopted as widely as possible, one of the audiences the *Standards* must reach is the decision makers who guide curriculum at the state level. As Thompson and Rathmell note, "The expectation is that the *Standards* will influence curriculum writing at the state and local levels and that the resulting curricular changes will influence the content of textbooks adopted by states and school districts" (348).

The *Standards* are intended to be read by the audience of state curriculum specialists as a prescription for what elements must be present in a statewide mathematics curriculum. The *Standards* simply claim for themselves a "framework for curriculum development" and not "a listing of topics by specific grade level" (252). Nevertheless, it is the NCTM's hope that the *Standards* will be accepted as written by individual states. The fact that more than 17 states have adopted the *Standards* in whole or part testifies to the success of the NCTM's rhetoric. That rhetoric entails
a "fundamental restructuring of the mathematics curriculum and instruction" (251). The NCTM's rhetoric in the Standards is responsible for many changes in state curricula, and understanding how the Standards function on this level is vital for a greater understanding of educational reform in this country.

The NCTM Standards: The Elite Needs the Public

The third audience that needs to be considered is what I would term "concerned parents." The NCTM includes parents as a target of the C&E Standards, as evidenced by the fact that the NCTM has issued brochures to be given to parents urging them to advocate the C&E Standards by teachers and principals in their school districts.

Indeed, there is an awareness among educators that parents know what they want in the curriculum. As one math educator put it,

"Complicating the implementation of the Standards is the timetable which many parents have from experience with older children, nieces and nephews, and friends' children that tells them that students should have certain skills mastered by particular grades e.g. math facts mastered by Christmas in fourth grade, etc. These assumptions are reinforced by the Iowa Test of Basic Skills which assume that fifth graders indeed should have learned simple manipulation of fractions" (Peterson n.p.)

Parents do bring certain expectations to the Standards debate, most notably that their districts will not suffer as a result of the Standards, and that their children's
education will incorporate the Standards as well as traditional basic skills. Ball explains that "the public wants students to be able to reason but also expects 'math' in school to include all the things they remember from their own schooling" (15). Parental expectations lead to a great incongruity that the text itself cannot address.

One of the concerns that parents bring to the C&E Standards is the use of technology in the classroom. For many parents, technology is a double-edged sword. Their children should be fluent in the use of computers and calculators, and indeed, many children have at least one of those items. Yet by the same token, the children should be able to handle paper-and-pencil computations.

The C&E Standards are quite bold about what technology should be in the classroom. The text argues, "Calculators, courseware and manipulative materials are necessary for good mathematics instruction; the teacher can no longer rely solely on a chalkboard, chalk, paper, pencils, and a text" (253). The Standards advocate that calculators should be available to every student at all times, and computers should be available for individual and group study (8). Interestingly, the Standards never make the plea for paper-and-pencil facility and, in fact, discourage it. Parents' fears about their children being unable to perform simple computations are only indirectly addressed.
Surprisingly, the NCTM's brochure to parents does not resolve this issue. The first two paragraphs refer to the traditional curriculum: "Over 75 percent of all jobs require proficiency in simple algebra and geometry as a prerequisite for training or licensure" ("For Parents" 1). This is ironic given that some members of the NCTM would like to phase out the traditional sequence of algebra and geometry courses and replace it with a different sequence, one that is suggested in various NCTM publications.

The brochure defines in a general way the goals of the C&E Standards and the Professional Standards. The boilerplate nature of the text is evident when compared to the other brochures about the Standards: approximately 2 1/2 pages of the brochure are identical in each brochure.

In my judgment, the Parents' brochure fails to persuade its intended audience in four specific areas. I will identify these areas, and show why the NCTM's claims need improvement.

Claim #1 is that NCTM will "provide a framework that helps mathematics teachers instill a knowledge that is uniquely personal to each student."

This argument for the Standards would concern many parents because they feel that there is a core of knowledge each student should be expected to master. For example, many parents feel that the times tables through 12 should be
mastered, as should paper-and-pencil algorithms for addition, subtraction, multiplication, and division.

The NCTM does address this issue in the C&E Standards. The C&E Standards highlight very clearly what K-8 classrooms should cover in mathematical content. The 9-12 standards are somewhat more ambiguous, in that they recommend a core curriculum with content differentiation. In other words, 9-12 students would be responsible for understanding seven content areas, with the depth of instruction in each area dependent on the student's ability level.

At certain points in the 9-12 standards, there is a difference noted between "college-intending" students and other students. For example, college-intending students should be able to construct indirect proofs and mathematical induction proofs (143). Also, certain problems are addressed in four different levels of formalism, with level 4 being the most abstract and formal. However, even within this schema, the NCTM makes classification errors. One problem urges the students to find a mathematical model describing the movement of a ferris wheel. At level 2, they are simply given an equation to plot, while at level 1, they have to construct a table of values. Level 2 is not more abstract than level 1, nor does it fit with the NCTM's vision of eliminating simple computational tasks (164).

The other problem with this argument is that the NCTM's rhetoric is at times self-contradictory. When we consider
the first claim, we see the phrase "instill a knowledge." The phrase implies that the teacher is giving the knowledge to the student. Yet, it is the student who is supposed to be handling the discussion, especially in the higher grades. Instead of deemphasizing the teacher, this phrase places the teacher in the center of the discussion.

Claim #2 is that parents will "increase teachers' awareness of the need for change, and help them reflect on what they are doing in the classroom."

One of the problems with this statement is that parents believe that the system is poor, while their own teachers are good. Thus, parents would not necessarily see the need for their children's teachers to change. Further, if the idea of change is not communicated clearly, then parents will assume that the NCTM Standards are simply another "New Math" (Ball 16).

Also, many teachers may not necessarily be convinced that parents should help them make changes in their teaching practice. Just because a parent may want her or his teacher to adopt the Standards does not mean that the teacher will necessarily consider the parent's request. If anything, this could prove counterproductive. Parents are typically concerned about test scores, and press their teachers to increase their school's overall score. Since the Curriculum and Evaluation Standards are largely incompatible with
present standardized tests, many parents would be concerned that their children will "fall behind."

Claim #3 is that the NCTM requires readers to be "challenging your own myths about mathematics."

This line is particularly troubling because the NCTM never indicates what beliefs held by parents are myths and which are not. I would assume that the NCTM is referring to the belief that only certain people can succeed in mathematics, and that mathematics is simply a collection of rote formulas to be learned. The Standards advocate "a vision of mathematical power for all in a technological society," but never make the link to the myths that individual parents have ("For Parents" 2). Thus, the NCTM fails to show parents how the Standards can help remedy their myths about mathematics. The NCTM simply needed to identify which myths the Standards seek to address.

Claim #4 is that parents should be "encouraging innovation in schools."

Again, the brochure suffers from a rhetorical shortcoming: parents are never told what kind of innovation the NCTM has in mind, and how that would effect what is traditionally taught in schools. We assume the Standards are innovational, but the brochure is abstract in terms of what types of innovation might happen in an actual classroom. The
brochure highlights "instruction based on real problems," but "real problems" are never defined ("For Parents" 3).

**Business Leaders as Audience:**

The NCTM also seeks to engage business leaders in accepting the C&E Standards. The NCTM has customized their basic brochure by describing the Standards for business leaders.

The NCTM believes that businesses have a stake in the mathematics education of their potential workers. They establish their evidence at the beginning of the brochure: "With the development of a more competitive global economy and the use of more advanced technology in the workplace, there is increasing demand that all young people master even higher level mathematical skills" ("For Business" 1). The problem with this argument is that the NCTM does not specify what "higher level mathematical skills" means in the brochure. One has to read the remainder of the Curricular and Evaluation Standards to recognize that the NCTM's curriculum is what is taken to be higher mathematics. If business leaders only saw the brochure, they would assume that more students need to study calculus and other related courses, instead of having a broad-based mathematical foundation.

The NCTM continues the emphasis on mathematics in the job setting by observing that "Yesterday's shopkeeper
arithmetic has given way to the need for nonroutine problem solving" (1). This emphasis continues a few lines later: "For the U.S. economy to remain vital and competitive, and for all our young people to enjoy successful careers, every student must graduate from high school with the expertise in mathematics that will be needed for the 21st century" (2). The difficulty is that the NCTM only asserts these statements without offering substantial proof. The C&E Standards offer the same quotation about shopkeeper arithmetic as in the brochure, with a citation from a talk given by an industrial mathematician at a conference in 1987. By not giving more detailed proof, regardless of the validity of the NCTM's position, the NCTM has simply asserted rather than demonstrated one of their most crucial arguments.

The real thrust of the NCTM's interest in the business community is to procure the necessary finances. The brochure continues by stating, "To help develop the work force you will need for the next century, the business community must cooperate with the educators who are implementing the NCTM Standards" (6). This is reemphasized in a transparency ready for meetings about the Standards, in which the NCTM clearly defines one of the roles of business leaders: to "support decisions made by the mathematics education professional community" (Blackline Masters 152). In other words, the business community is encouraged to "rubber stamp" the NCTM's proposals through verbal and financial support. Business is
supposed to help by volunteering in schools, ensuring that resources are available to enact the Standards, and providing internship opportunities to teachers (6). Many business leaders would not choose to provide large amounts of money and time for a document they did not have a significant role in creating.

**The Curriculum and Evaluation Standards: Transforming or Innovational Rhetoric?**

The NCTM Standards sees itself as part of a larger rhetoric of reform. One of the Standards' architects, Thomas Romberg, called the NCTM Standards "the exemplar of what is needed in all curricular areas if we are to reform American education during the coming decade" (36). Others have compared the Standards to a variety of other educational reforms in English, history, and other subjects (O'Neil 4).

The NCTM Standards is filled with conflicting rhetoric. The rhetoric has qualities of both a transformational movement and an innovational movement, but does not fully belong to either genre. To justify this argument, I will examine the theory of transformational movements as well as innovational movements previously defined in the chapter, and analyze the paradox the NCTM C&E Standards has created.

**Problem Solving and the NCTM Standards:**

The rhetoric of transformation in the C&E Standards is based on the notion that problem solving needs to be moved to
the forefront of the curriculum. One of the features of the C&E Standards that entices the reader is that on the surface, the C&E Standards deal with problem solving. Through the judicious repetition of the term, many teachers believe that the purpose of the C&E Standards is to show them how to better teach problem solving to their students. This is especially important given that K-8 teachers are the most likely to look for new ways of teaching problem solving in the integrated curriculum of the elementary classroom. The K-4 standards specifically address the issue of tying mathematics to other curricular areas, and this focus is continued through the 5-8 standards. In fact, one of the important stylistic devices of the C&E Standards is that mathematics is to be interwoven as a unit: currently, "computation, geometry, measurement and problem solving tend to be taught in isolation" (32). The C&E Standards envision a view of mathematics that subsumes all other subject areas. The Standards suggest tying mathematics to other content areas such as English, science, and social studies. Teachers who examine the C&E Standards for subject ideas could find this version significant and helpful.20

The Agenda for Action argued that problem solving was central to the curriculum and that "problem solving must be the focus of school mathematics in the 1980's" (2). Indeed, the C&E Standards cite this recommendation of the Agenda for Action and basically keep it: the K-4 standards suggest
"problem solving should be the central focus of the mathematics curriculum" (23). This in itself is scarcely innovational, and indeed, many traditional teachers believe that they are teaching their students effective problem-solving techniques.

The discussion of problem solving in the C&E Standards is fairly extensive, yet the term itself is barely defined. The C&E Standards note that problem solving "is the process by which students experience the power and usefulness of mathematics in the world around them" (75). This definition, however, is vague: a mathematics student could read a historical narrative about a mathematician and find the usefulness of mathematics without engaging in problem solving. Other definitions of problem solving are also vague. The 9-12 standards note, "mathematical problem solving, in its broadest sense, is nearly synonymous with doing mathematics" (137). It is also labelled in this same section as "a process by which the fabric of mathematics as identified in later standards is both constructed and reinforced" (137).

Thus, one of the problems in defining the C&E Standards as transformational is the lack of a coherent definition of problem solving. Problem solving becomes intuitively known: "I know good problem solving when I see it." The Agenda for Action, which defines problem solving somewhat more clearly, also reveals that "Educators should develop and disseminate
examples of 'good problems' and strategies and suggest the scope of problem-solving activities for each school level" (3). Yet, even in that document, problem solving is defined by what it should not be: not limited to "the conventional 'word problem' mode" or computational activities "in isolation from a context of application" (3). It is "a creative activity" (4). It is very difficult for teachers to instruct students in problem solving if they do not know what constitutes problem solving. One of the problems, then, in the C&E Standards is that an important term is defined intuitively, and thus, serves as a barrier to the Standards' acceptance.

Transformational Turns in the Standards:

The C&E Standards, however, do make other efforts to be transformational. Some of the authors of the Standards see a revolutionary role: as Leinwand argues, "The bedrock upon which this entire reform movement rests is a clear understanding that society's needs and expectations for schools have shifted radically" (392). The belief here is that since the society has shifted radically, the Standards must shift mathematics education radically as well.

The way for the Standards to make a great transformation is to gain a populist, grass-roots reform. Indeed, this is how the major authors of the Standards view their work. As Crosswhite observes, "In the Standards project, a major
effort is being made to generate a grass roots reform movement as well as to work with test and textbook publishers to make appropriate materials available to support that reform" (457). Further, Crosswhite contends that the Standards are "part of a larger reform movement that encompasses all aspects of mathematics education at all levels" (458). Additionally, the NCTM has released a videotape that supports the transformational nature of reform. The videotape, "Mathematics: Making the Connection," suggests that the Standards are revolutionary. In particular, Wynton Marsalis represents the "cutting edge" of jazz, and the NCTM clearly tries to borrow from that persona by using him on the videotape. This is also designed to appeal to teachers as well as parents in the manner of traditional advertising appeals: if noted celebrities such as Wynton Marsalis and Geoffrey Owen of the "Cosby Show" feel the Standards are worth considering, then they should be in the classroom. Interestingly, Marsalis never mentions the Standards by name, nor do the other people interviewed on the videotape. In the interviews with celebrities, the fact that the Standards are not mentioned leads one to conclude that the reform is more hinted at than actually suggested. The videotape, then, does not fully engage the audience in the Standards debate, but instead, seeks to reassure the audience of the utility of mathematics.
Transforming the Previous Curriculum:

The *Standards* clearly see themselves as central to a transformation of mathematics curricula: "What we have done is to identify the primary elements, or nodes, of the network to be included in a quality mathematics curriculum" (252). In fact, each of the brochures puts it succinctly: "The *Curriculum and Evaluation Standards* tells what needs to be taught in school" (3).

In the K-4 Standards, the NCTM casts the villain as the "existing curriculum." In the NCTM's view, the existing curriculum prohibits students from learning new material until basic mastery of computational skills has been gained (66). In fact, as the text suggests, "If students have not been successful in 'mastering' basic computational skills in previous years, why should they be successful now, especially if the same methods that failed in the past are merely repeated?" (66). Instead, the C&E Standards suggest that a broad range of topics should be taught, such as estimation, functions, probability and statistics, and geometry--with the connections between the topics as the prominent feature of the curriculum (67). This is where the transformation takes place. Since the old curriculum is found wanting, a new curriculum must be established. The videotape further elaborates the argument that the *Standards* are revolutionary by stating, "The NCTM is initiating real changes in mathematical process."
The Standards as Innovational Movement:

Another way of approaching the Curriculum and Evaluation Standards is to examine them as an innovational movement. The NCTM does not seek to radically overhaul the school as it exists, but rather, to modify the school and make it a more conducive place to learn mathematics.

The innovational movement accepts the notion that change may be gradual. The NCTM has anticipated this objection by arguing that true change will take time; as one researcher argued, "I believe that change needs to be measured over years and possibly decades" (87). In fact, the C&E Standards claim they "see the Standards as an initial step in a design-change process" (251).

As Smith and Windes put it, the innovational movement's spokesmen do not want to call attention to division (143). There must be a unified front for the innovation to be complete. In the NCTM's journals, there is a fairly unified front supporting the Standards. However, while the NCTM has created standards that tried to include diverse voices, they have repudiated several voices.

Criticism of the Standards is marginalized, and only found in small sections of the NCTM's journals. Indeed, a four-year examination of NCTM journals found only three negative responses to the NCTM Standards, and one letter supporting the Saxon textbook series, textbooks not in favor with the NCTM leadership.
The NCTM restricts permissible communication, such as critics of the Standards. One mathematics educator commented, "why, though, are people with reservations about the party line relegated to 'Reader Reflections'?" (Schwartzman 372).\textsuperscript{23} Schwartzman and Enoch Haga both commented that articles "genuflect" to the C&E Standards (356, 372).

The point of Schwartzman and Haga is important for the rhetorical critic. Bormann and others suggest that certain key words and phrases must be agreed upon in order for a vision to be shared with other members of a community. Clearly, the NCTM journals are accused here of repeating "Standards" until the term has lost its meaning. The vast majority of articles published in the NCTM journals cite at least one of the Standards volumes, if only in passing. The Standards no longer become important because of their intrinsic worth, but only as a necessary citation in an academic article. In addition, the other concern is that the rhetoric of the C&E Standards is not one of diversity, but rather a rhetoric of conformity. Only certain voices are allowed to speak; those who do not follow the official NCTM line are unable to publish in its journals.

Since the NCTM relies in part on advertising revenue, they must open the journal to advertisers. One of the advertisers is John Saxon, whose textbooks are very much against Standards practices. Only once in four years did the
editor of a journal even refer to Saxon, and that was in passing in "Reader Reflections." Saxon is able to put his advertisements in the journals, but since no articles are published about his teachers' successes, his voice is muted. This follows the model Smith and Windes suggest: the NCTM is not calling undue attention to division, but rather, portraying Saxon as simply another textbook publisher. Saxon must keep within certain guidelines, such as not directly attacking the NCTM. He has only managed one direct attack of the NCTM in print, contending that "We believed we knew what we were doing and refused to acquiesce to the demands of the NCTM" (290). Indeed, one of the ways the NCTM has silenced Saxon is by not publishing his advertisements for several months in 1994.

Given that one of the purposes of the C&E Standards is to encourage a student's point of view, we also must consider the student as narrator. One of the key omissions of the C&E Standards is that students are not given a place to reveal their concerns. We are simply told that all students are to participate in the Standards, not just the brightest mathematical students. The Standards are also designed to identify all subjects that every student must learn. Thus, we are forced to move outside the text in order to examine the ways in which students might make sense of a Standards classroom. Given that students are supposed to be empowered by the C&E Standards to reach "mathematical power,"
we see little of their interaction with mathematics, except as refracted by the powerful voice of the NCTM. The students are simply mentioned in passing.

In order for an innovational movement to succeed, it must not be infused with guilt (Smith and Windes 143). In other words, the innovational movement must believe they did the best they could.

While this appears to be self-evident, the rhetoric that results can be highly defensive or apologetic. In particular, the NCTM relies on the strategy of bolstering. The defense of the C&E Standards relies on two basic premises: the NCTM had many reviewers examining the text, and the NCTM tried to include all relevant perspectives. Many of the Standards authors, such as Ball, Crosswhite, Cooney, and others, refer to the many hundreds of educators who sent in comments about the C&E Standards. Indeed, the preface to the C&E Standards notes that "we are confident this document represents the consensus of NCTM's members about the fundamental content that should be included in the school mathematics curriculum" (v).

Attacking the Institution:

The second task an innovational movement must accomplish is to emphasize the weakness of traditional institutions and the strength of traditional values. In other words, "advocates must criticize institutions and point to areas of
critical failure" (144). Here is where the NCTM fails to meet the innovational movement paradigm.

The NCTM has several potential scapegoats it could exploit. First, the NCTM could criticize the educational community for not accepting mathematical reform. To do this, however, would alienate the audiences that must accept the Standards, such as the curriculum reform specialists. Likewise, schools cannot be attacked directly, since, ultimately, they will be the sites of reform.

Educational theory is another possible scapegoat, although even here, the criticism must be tempered. For much of the theory the NCTM attacks in the Standards is held by NCTM members themselves, and was created in part by the NCTM. Accordingly, we can see the rhetorical dilemma: the NCTM cannot attack pedagogical theories about mathematics, and it cannot claim that the Standards are "new and improved," for fear of resurrecting the "new math" charge.

The only type of criticism the NCTM has left is an ambiguous attack on the difficulty of education. As the NCTM itself points out, "The Standards document has captured a spirit detected in many parts of the mathematics education community; namely, the need to reform the character of precollege mathematics education to make it more intellectually stimulating for students" ("NCTM Curriculum" 340-341). The Standards are not needed for a goal this basic; intellectual stimulation can take place in individual
classrooms, and does not require massive structural change. The ambiguous part of this attack is that it is not centered in any one area: teachers, schools, parents, and students themselves could easily be held accountable.

As Smith and Windes observe, "If the innovational movement is successful in the first two strategies, no defendant spokesmen will emerge, and no dialectic between aggressors and defendants will be possible" (144). This leads us to consider the final requirement of an innovational movement: it must create a dialectic between scene and purpose. In other words, the innovational movement must not engage particular opponents in conflict; rather, it must limit its attacks to impersonal institutions. The NCTM has failed this requirement.

Earlier in the chapter, I mentioned the work of John Saxon, a textbook publisher, whose textbooks are a throwback to older methods. His books emphasize review over new material, with approximately 75-85% of each day's lesson as old material, and a few problems dealing with new material. While the NCTM has not attacked Saxon in its journals, representatives of the NCTM have been critical of Saxon in public forums, most notably, the pages of Newsweek magazine. One of the leaders of the NCTM, University of Maryland Professor James Fey, argued that the Saxon textbooks "train students in a fairly well-defined traditional collection of problems, and our belief is that kids need a more flexible
ability to apply their mathematics to novel problems" (Mathews 62).

Ultimately, we must conclude that the NCTM is not an effective innovational movement, despite their attempts to be so. They have violated Smith and Windes' injunction against finding a villain, as well as being unable to find a suitable institution to attack. John Saxon has become the NCTM's villain. Ironically, Mathews notes that only 12 states have any of Saxon's books on their recommended textbook list (63). Thus, the NCTM has created a "strawman" by villifying a fairly minor character.

The Paradox Between Transformation and Innovation:

With respect to the NCTM Standards, as Chambers points out, "teachers should be able to discuss the rationale for this particular vision. If reform is needed, why is this reform better than other reforms that might be proposed?" (550). The NCTM is the major proponent of reform, with only the slight dissenting voice of John Saxon. So the question should be rephrased, "If reform is needed, why is this series of reforms better than what has taken place before?" The rhetorical problem is similar to the situation facing many movements: the NCTM needs to show how everybody could be wrong even though the underlying mathematics itself continues to be right37.
One of the problems lies in the nature of the text: because the story is composed of multiple narratives with multiple interpretations, people can read many different ideas into the *Standards* (Ferrini-Mundy and Johnson 190). There is a certain level of intentional ambiguity within the text. The NCTM considers change as follows:

"The next steps toward change should not be considered as linear or exhaustive but rather as steps along many paths headed in the same direction. Professionals in different areas follow different paths to redesign components for a new system of school mathematics" (251-252).

The *Standards* were intentionally written to support multiple interpretations and multiple pedagogical theories. Coste recognizes, "an act of communication is narrative whenever and only when imparting a transitive view of the world is the effect of the message produced" (4). The problem here is that while the NCTM is producing a transitory view of the world--there is a change that is needed in mathematics education--people cannot agree as to what type of changes are needed. On some basic level, there are certain notions of the *Standards* to which all must agree. For example, most would concur that students must confront a variety of problem-solving situations. Ultimately, teachers and mathematics educators differ at the curricular level--the actual practice of the *Standards*. Indeed, the *Standards* does not choose to become involved on this level: "What we have done is identify the primary elements, or nodes, of the
network to be included in a quality mathematics curriculum. One possible next step is for teachers and mathematics educators to develop curricula based on the Standards" (252). The curricula should be different from past curricula, but the steps to make the curricula different are not made plain.

The NCTM did not resolve the break between past and present reforms. In failing to demonstrate how the Standards are far superior to the Agenda for Action, the NCTM failed to persuade its audience. As Macintyre notes, "When an epistemological crisis is resolved, it is by the construction of a new narrative which enables the agent to understand both how he or she could have intelligibly held his or her original beliefs and how he or she could have been so drastically misled by them" (56). Quite simply, the NCTM has great difficulty in creating this type of conversion. Instrumental teachers could see how their practices did not measure up to the Standards, and that their beliefs were wrong, but felt their old beliefs were ridiculed as being too illogical. In fact, many teachers feel like they cannot share in the vision of the Standards. Leinwand suggests that the C&E Standards did not succeed in accomplishing its rhetorical goal because teachers feel inadequate to perform the reforms, and the break between past and present performance is too radical (392). As Cooney notes, "many teachers not surprisingly try to create successful classrooms
by compromising whatever reforms may be intended in order to accommodate students' expectations" (359).

Additionally, the NCTM failed to resolve the break between past and present reforms because the Standards are not novel at all: E.H. Moore in his address to the American Mathematical Society in 1902 echoed some of the same themes as the Standards of the late 1980's (House). Other scholars have come to the same basic conclusion: "The NCTM C&E Standards is trumpeting a collection of recommendations that are actually not new" (Lambdin 8). In the eyes of skeptics, then, the Standards are less a movement and more a restatement that fails completely to capture its audience.

The C&E Standards sees itself as a "bold vision" for mathematics education. However, the Standards are not quite bold or revolutionary enough. In order to persuade instrumental teachers to accept the reforms, the Standards have some element of compromise. As Ball observes, "if these standards were to stand as the banners of the community, they had to reflect shared values and commitments" (2-3). The only way to obtain shared values is by toning down the more radical parts of the message.

Do the Curriculum and Evaluation Standards Succeed?

The initial impressions to the C&E Standards were highly positive. Members from outside the mathematics education community generally praised the Curriculum and Evaluation
Standards. President Bush's Secretary of Education Lauro Cavazos called the Standards "a welcome vision of what mathematics education can--and must become" (cited in Kirsner 555). Carnegie Foundation president Ernest Boyer was equally accommodating, generally praising the Standards for their forward thinking. In fact, over 30 professional organizations also backed the Standards, including most of the major content area associations such as the National Council of Teachers of English and the National Council of Teachers of Science. Thus, to many educated laypeople, the rhetoric of the Standards must have been convincing.

Closer inspection, however, reveals that this influence must not have been as thorough as perhaps its designers had planned. We do not have enough empirical data to know about individual teachers and their reactions to the Standards; most of what we know comes from a couple of exploratory surveys. The data that exists suggest the Standards may have a long way to go. One of the first studies about the effectiveness of the C&E Standards suggests that only 17.6% of teachers at the K-4 level are familiar with it (Parker and Kurtz 622). Further, the teachers in the study "tend to stress practices the Standards recommend for decreased attention and tend not to stress practices the Standards recommend for increased attention" (628). While it may be premature to say the Standards have not succeeded, it is fair
to say that the *Standards* have not been fully accepted by many practicing teachers.

Two questions, therefore, come to mind: Why have the *Standards* not been adopted by more teachers, and are the problems of the C&E *Standards* resolved in the *Professional Standards*? The latter inquiry will be answered in the next chapter, but I would like to suggest some answers to the former question.

One problem the NCTM has is credibility. One mathematics educator spoke for many in the profession when he argued: "no one trusts those friendly folks who gave us New Math. Any change suggested by these jokers is suspect" (Roach, n.p.) There is a great distrust in some segments of the mathematics education community that needs to be resolved. The *C&E Standards* do not really see this as a problem that must be dealt with because the emphasis in the *C&E Standards* is to establish an agenda.

One possible reason this distrust becomes important is because the *Curriculum and Evaluation Standards* take on an moral tone. As Booth notes, narrative not only takes a moral tone, but also provides counsel for readers. The NCTM believes that the *C&E Standards* "should lead to a fundamental restructuring of the mathematics curriculum and instruction" (251). The problem is that if people do not believe the NCTM, the text will not be persuasive.
The NCTM certainly sees itself as a prophet, noting in the *C&E Standards*, "Through their professional organization, NCTM, which best reflects their interests and the mathematical learning of their students (emphasis in original)" (254). This emphasis can be found throughout the *C&E Standards*; indeed, the *C&E Standards* are to be taken at times as gospel by professional educators.

Moral rhetoric is most effective when all people are constrained to the same conditions, and when all people are included in the moral. One problem with the NCTM's rhetoric is that certain voices are not included in the NCTM's vision of future pedagogy. As we have seen earlier in the chapter, segments of the mathematics education community do not feel like they can speak.

Additionally, teachers teach as they were taught. As Kirsner notes, "If we expect teachers to teach mathematics as the *Standards* recommends, then teaching in our postsecondary institutions should model this vision" (557). Unfortunately, that is not yet the case. Changes often filter down in the educational system instead of upward. Kirsner's argument is that if we expect the *Standards* to succeed at the K-12 level, they must also be enacted at the collegiate level. In order for this to happen, there must be great changes in pedagogical practice, which is the focus of the next chapter.
Notes:

1. Throughout the chapter and the rest of the dissertation, I will be using the standard abbreviations found in the education literature such as K-4, to represent kindergarten through fourth grade. I will also use C&E Standards to represent the Curriculum and Evaluation Standards.

2. It is my contention here that revolutionary rhetorics do not have to rely upon the strategies of agitation or violence. Certainly, we see in the rhetoric of Martin Luther King, Jr. a rhetoric of non-violent revolution.

3. Indeed, the NCTM's press kit suggests that parents, news organizations, and others interested in the state of mathematics education should contact the NCTM directly.


5. As Lessl notes, the materials of religion are relevant to the rhetorical objectives of science. See "The Priestly Voice," p. 188.

6. This analysis borrows heavily from the notion of evangelical rhetoric. See Michael Dreher, "Is It 'More Complicated than That?' Examining Daniel Vestal's CBF Address in Light of Burke," presented at the SCA Convention, New Orleans, 1994. I would contend that elements of the NCTM's rhetoric have evangelical characteristics.

7. This is a further reduction from the NCTM's claim in 1959 that there were 32 basic ideas in elementary mathematics. See The Growth of Mathematical Ideas, Grades K-12, 24th Yearbook (NCTM: Washington, D.C., 1959, 480-489).

8. In other words, calculus was no longer to be the pinnacle course in high school mathematics. Instead, other courses, such as probability and statistics, were to be included in the secondary program (20-22).

9. To this day, they still have not been done by the NCTM, although some have suggested expanding the standards to grades 13-14 classrooms (I use this term as it is accepted in the education community). The major thrust to expand the Standards to the junior college classroom has been by AMATYC (American Mathematical Association for Two-Year Colleges), which has a draft document entitled Standards for Introductory College Mathematics. The 1995 AMATYC national
conference will be on the Standards, and will explore the links between the 13-14 Standards and the K-12 Standards.

10. Yet, many articles have been published about the subject. See Thomas J. Cooney, "The Issue of Reform: What Have We Learned From Yesteryear?" (Mathematics Teacher 81: 352-363). There are at least 10 additional articles concerning teacher effectiveness.

11. Interestingly, this point is most likely based on the author's experience. However, many mathematics educators would likely agree with the categories Cooney identifies.

12. The term "fundamental narrator" will be used synonymously with "fundamental teacher," and similar substitutions will be made for the other teacher types.

13. Indeed, they would not have been picked as writers of the Standards if they did not question the assumptions of previous reforms in mathematics education.

14. This comment also suggests a research strategy for evaluating the Standards: ethnographic studies that take students' perspectives into account. Indeed, students are interviewed in promotional tapes for the Standards. However, to my knowledge, no ethnographic studies have taken place that evaluate whether students learn more effectively in Standards-oriented classrooms. The first social scientific studies have yet to be published.

15. This finding is certainly not new. See James T. Fey Patterns of Verbal Communication in Mathematics Classrooms (New York: Teachers College Press, 1970), and Michael Dreher, "An Analysis of Teacher-Student Communication in the Secondary Mathematics Classroom." (Paper presented at Speech Communication Association, Atlanta, 1989), both of which quantitatively demonstrate that the traditional patterns of 1960's pedagogy were alive and well in the 1970's and 1980's. Both authors found that students were responsible for only 30% of the communication, both in terms of time as well as turn taking.

16. This also becomes crucial in the Professional Standards.

17. I will use this term synonymously with "everyday narratives" in the sense that Labov uses the term.

18. Page numbers here refer to transparency numbers; hence (Blackline Masters 152) refers to transparency #152.

19. At least in theory.
20. This is why the NCTM has chosen to add to the *Standards* with a 25-volume *Addenda*, which is composed of various problems and situations for teachers to use in classrooms.

21. Indeed, the same can be said of the electronic mail list NCTM-L, in which most of the key participants are staunch supporters of the *Standards*.

22. These textbooks are in disfavor because they incorporate some drill and practice, and because they specifically do not call attention to the *Standards*. The debate over the Saxon series is typically emotional on both sides. See Jay Mathews, "Psst, Kid, Wanna Buy a ....." (*Newsweek* 1 March 1993: 62-63).

23. "Reader Reflections" is the letters to the editor section of the *Mathematics Teacher*.

24. This quote actually surprised me, as the NCTM would normally censor such a statement.

25. For the most part, ethnographies of *Standards* classrooms are still being written. There are a few videotapes about the *Standards* (which will be discussed in chapter six), but these are not so much reflections of actual classrooms as they are publicity for the *Standards*. The book mentioned here is perhaps the best and longest ethnographic/narrative account of the types of reforms the *Standards* call for. It mentions four years worth of study. Most of what is published in the *Mathematics Teacher*, *Teaching Children Mathematics*, etc., could properly be labelled as vignettes of various lessons. This book was chosen because it is the best available touchstone with regard to *Standards* ideas in the classroom.


27. See page 166. The paraphrase substitutes mathematics for "science," which appeared in the original. I believe that the spirit of the quotation, which dealt with the realm of science, is equally valid in mathematics. See Begley, who notes, "The trouble is that some science is not just mathematical, it's practically mathematics" (73).

CHAPTER 4

PROFESSIONAL STANDARDS

Introduction:

Shortly after the publication of the C&E Standards, reviewers inside and outside mathematics education highlighted one weakness in the text: it did not deal with the practice of teaching. While content was the focus, teaching was implicit rather than explicit in the C&E Standards. In terms of the C&E Standards' overarching theme, the notion that all students should possess mathematical power, the definition was incomplete. The C&E Standards had defined "mathematical power" for the student, but still left unmet the need to define the term for the teacher, and more specifically, in terms of the teacher's ability to help students gain mathematical power. As the NCTM notes, to reach mathematical power requires "the creation of a curriculum and an environment in which teaching and learning are to occur, that {is} very different from much of current practice" (emphasis added; Professional 1). The NCTM believed that "The current reform movement in mathematics education, and in education in general, has as a strong underlying theme the professionalism of teaching" (Professional 6).

The initial problem, though, was that the NCTM separated content and method (Ball 5). Boyer argued that the C&E Standards failed to include "a good description of practice that moves in the direction of the reforms" (563-564). Those
writing the Standards felt "one could envision actual classrooms," but many reading the Standards still needed more guidance (Ball 5).

Accordingly, the NCTM felt it necessary to develop a companion to the Curriculum and Evaluation Standards that dealt with mathematics teaching. The result was the publication of the Professional Standards for Teaching Mathematics in 1991. The Professional Standards was designed to "give direction for moving toward excellence in teaching mathematics" (7). The Professional Standards, though, "circumscribes themes and values but does not--indeed, it could not--prescribe 'right' practice" (22).

Many of the readers of the Professional Standards had already read the Curriculum and Evaluation Standards. In fact, through its marketing strategies, the NCTM encouraged people to buy both volumes of the Standards by offering generous discounts.¹ Thus, much of the initial audience had some degree of familiarity with the reform movement as espoused in the Standards, but felt like they needed to read more about the Standards.

However, a new audience was encouraged to read the Standards: preservice mathematics teachers. The Standards were assigned in a variety of college mathematics education courses at both the undergraduate and graduate levels. Education majors had some ideas about the previous reform movement, but they were not as sophisticated an audience as
the teachers and professors who had been a part of An Agenda in Action and other reform movements.

The NCTM also sought to make copies of the Standards available to teachers who were not NCTM members. Since only approximately one in four mathematics teachers on the high school level and one in eight teachers on the grade school level were NCTM members, many people were not aware of the reform movement in mathematics education. The NCTM sought to find this audience in the Standards.

Finally, the NCTM tried to encourage others to read the first two volumes of the Standards. They sought to sell the Standards to administrators, specialists, school board members, and even members of the general public. By 1991, the publicity campaign alluded to in chapter three was in high gear. The goal of the NCTM was to distribute the Standards to as many audiences as possible. When people read the Standards, the NCTM felt, they would find the reforms to be logical and reasonable, and people would urge changes at the local school level.

The Professional Standards as Narrative:

The Professional Standards differ in style and content from the C&E Standards. The C&E Standards were designed as a standard reference work, while the Professional Standards were written as a series of vignettes and experiences. Because the Professional Standards are different, a different
method of analysis is necessary. Thus, our analysis of the
Professional Standards must identify the creators of this
text apart from the C&E Standards, investigate the nature of
the text, and explore whether the second volume of the
Standards was successful.

I contend that we can best understand the Professional
Standards as a narrative for four reasons. First, as it is
in vignette form, we are encouraged to read the Professional
Standards as a narrative. The text suggests that
"Narratives--drawn from actual school and university
classrooms...are meant to be like video clips...and help to
build depth into the images created by this document" (11).
Further, the Blackline Masters define vignettes as "brief,
vivid glimpses into diverse settings" (88). Since the device
of the annotated vignette is repeated more than 35 times, the
text compels us to investigate its narrativity. The text
consists of the vignettes tied together by an analytic
narrative.

Additionally, we must consider a method that recognizes
the importance of change. Narratives are texts about change.
Coste argues that narrative "is concerned with the
production, transmission, and exchange of information on
change and simulacra of change" (5). Since the whole point
of the Professional Standards is to encourage change in
teacher behavior, our method must be sensitive to the
importance of change. As the Professional Standards note,
"The continued commitment to the evolving process of change in school mathematics has become an NCTM baton, passed on by each president to the next" (viii).

Also, the Professional Standards are highly experiential. Indeed, many of the articles that support the Standards in the mathematics education journals are relations of experiences; in other words, the articles are narratives about what takes place in individual classrooms. Narratives are stories linked to experience (Sillars 154). Given the primacy of experience in the mathematics classroom, our analysis must recognize experience in a storytelling form.

Finally, there is a theoretical issue that needs to be resolved within the rhetoric of inquiry: the way in which rhetoric makes claims reasonable. Prelli suggests that one of the functions of a rhetoric of science is to identify discourse that makes claims reasonable as science, and then to find out how that discourse is used strategically (324). Prelli's contentions are equally valid in the rhetoric of mathematics: we must investigate the NCTM Standards, as they make claims about the reasonableness of pedagogical theory and about mathematics as a discipline. The Professional Standards are the exemplar of the strategic use of discourse, which takes place in predominantly narrative forms.

I do recognize, however, that the text takes on nonnarrative qualities, and thus, is a mixed narrative. As Coste explains, "Exposition (essentially made of nonnarrative
discourses) can occupy most or all of the tale, with markers that ask the reader to put to work its narrative program or programs" (261). Given that the Professional Standards contain both narrative and nonnarrative elements, I will address these qualities in light of interdiscursive articulation; that is, detecting nonnarratives in narrative discourse (Coste 208). Thus, I will employ the methods mentioned in the previous chapter to draw out the descriptive discourse of the Professional Standards.

Background of the Professional Standards:

The Professional Standards is organized into four major sections: teaching, evaluation, professional development, and support and development of mathematics teaching. Hence, the Professional Standards seek to work both within the classroom as well as deal with issues of academic and public policy.

The first section of the Professional Standards, "First Steps," introduces the device of annotated vignettes—deliberative narrative mechanisms. The first of the vignettes is meant to be an introductory vignette to demonstrate to readers how future vignettes operate. The first vignette is important to this study for two reasons. First, it intentionally foreshadows themes that are covered throughout the entire Professional Standards; it serves as an orientation for what follows (11).
Additionally, this vignette is a representative anecdote. Each of the major themes of the Professional Standards is addressed in the vignette. As we saw in chapter two, the representative anecdote must have sufficient scope. The first vignette previews the three major sections of the Professional Standards: the evaluation section, the teaching section and the professional development section (11). In addition, themes that run across sections are highlighted in the commentary: "Encouraging students to formulate problems on their own is an aspect of problem solving that is emphasized in both the teaching and evaluation sections" (13). Also, the vignette states, "How teachers can support one another is a continuing theme in this volume. All sections stress the importance of teachers paying attention to students' knowledge and their ways of thinking about mathematics" (12). Thus, there is both scope and the representation of the entire text, which satisfies Masden's criteria for a representative anecdote.

A Narrative Consideration of the Professional Standards:

In order to fully consider the Professional Standards in the light of narrative theory, I will examine the narrators of the text, as well as the text's philosophical assumptions. I will then take a detailed look at the first vignette, as it is critical to understanding the rest of the Professional
Standards. Finally, I will analyze the remainder of the text, focusing on the vignettes.

One of the problems with traditional narrative theory is that people mistakenly confuse the narrator and the author. I will draw the same distinction Coste uses: the "author would be responsible for the whole text, using an intermediate specialized instance--the narrator--to tell (within the text)" (166). This definition is superior, for it allows us the flexibility of speaking of an overall author--the NCTM, while at the same time pointing out potential inconsistencies and paradoxes that arise from the multiple narrators of the text.

The NCTM Professional Standards was written by several teams composed of university professors, practicing teachers, as well as other members. There were three different task groups: mathematics teaching, evaluation of mathematics teaching, and professional development of teachers of mathematics. Of the 19 people involved in the writing of the Professional Standards, five are listed as active K-12 teachers, thirteen are affiliated with a university, and one works for a state department of education. All of the groups were chaired by a university professor, which slightly discredits the NCTM's contention that the Standards are "bottom-up" instead of "top-down." The NCTM had sought to respond to one of the criticisms of Agenda for Action, which was the belief that not enough teachers were involved in its
production. In the Professional Standards, university professors comprised a majority in all of the working groups. Although the NCTM claims that the Professional Standards "represented a cross section of the mathematics community," it is clear that full-time K-12 teachers represented a mere fraction of the cross section, especially in comparison to their representation in NCTM (vii).

Given that the NCTM is the author, I will define the narrators as the teams that wrote each of the sections. This distinction is valuable because it allows us to examine the coherence of the work, as well as to investigate whether the narrators of the text are contradicting each other. Thus, we have three major narrators. The first narrator is the Mathematics Teaching working group, which wrote the first section of the text, "Standards for Teaching Mathematics." The second narrator is the Evaluation of Mathematics Teaching working group, which wrote the section of the same name. The third narrator is the Professional Development of Teachers of Mathematics, which wrote the section based on their name.

As Maclean observed in chapter two, we have to identify both the narrators and the audience of the énonciation of the narrative. In this case, there are a variety of lay and professional audiences, although the Professional Standards is geared predominantly toward mathematics teachers and supervisors.
The audiences for the *Professional Standards* are different from the audiences for the *C&E Standards* described in the previous chapter. The audience of concerned parents is no longer considered. Instead, several audiences are very briefly mentioned: policymakers in government and business, schools, colleges and universities, and professional organizations (177).

One of the audiences the NCTM is trying to capture is business, but more specifically, the textbook publishing industry. As they argue, "textbooks and tests have a profound influence on what is taught. Therefore, authors and publishers have both an opportunity and a responsibility to help improve mathematics instruction" (179). It is clear that the NCTM desires a whole series of textbooks in line with the *Standards*. What is not clear from the text, however, is how the *Professional Standards* are to work toward that goal. One can only assume that the *Professional Standards* will be a reference guide which editors of textbook publishing companies will use as they edit textbooks.

**Persuasive Elements of the *Professional Standards***:

In chapter two, I argued that the narrative must somehow entice the audience to listen. In other words, the *Professional Standards* must answer the question, "Why should I listen to the NCTM's viewpoint about mathematics?" The NCTM only gives one reason in the text. The justification is
that the Professional Standards is the logical extension of the C&E Standards. The C&E Standards argued, "Specifying the content for a quality mathematics program is impossible without addressing the accompanying instructional conditions" (252). The Professional Standards continue this thought in the introduction by stating, "To reach the goal of developing mathematical power for all students requires the creation of a curriculum and an environment, in which teaching and learning are to occur, that are very different from much of current practice" (1). The NCTM has positioned the Professional Standards as a response to those who wonder what the role of the teacher is under the Standards.

The assumption is that people who want to improve their mathematics teaching will naturally find the Standards helpful. The opening is entitled "Background and Rationale," yet there is very little rationale for a traditional teacher. The only piece of data that supports the belief that current mathematics pedagogy does not succeed is from a 1978 report which found that the sequence of activities found in a mathematics classroom rarely varied. This data itself simply reaffirms a 1963 monograph that made the same argument.3 Thus, the introduction does little to entice those who do not already support the NCTM's position. Indeed, the NCTM sets up a dichotomy by arguing, "Decisions made by others can enable teachers to move toward the vision of teaching described in these standards or can constrain the mathematics
program in ways that cripple efforts to improve teaching" (7). The lesson here is not very subtle: any program not based on the Standards will harm mathematics teaching. The problem with this approach is that the NCTM ends up "preaching to the converted." The NCTM assumes that people have already been persuaded by the C&E Standards, and so position the Professional Standards as a reaffirming text to strengthen existing attitudes for change.

Although the text itself does not compel people to read the Professional Standards, there are two other reasons why people might desire to read the text. First, people want to know what is good mathematics. With many horror stories about the state of mathematics education, people would be interested in what can be done to improve mathematics at the classroom level. Even those who did not agree with the C&E Standards could still read this text in an effort to see if there are pedagogical practices apart from other reforms that they could implement in order to improve mathematics instruction.

Additionally, those who read the C&E Standards found that the reforms described often were not accompanied by illustrative examples of how the reforms might be enacted in actual practice. The Professional Standards use illustrations from actual school and university classrooms, and thus, seek to create applied theory.
Narrative theory also forces us to examine what Lanser calls contact, or the relationship between the narrator and the receiver (91). The NCTM as author of the text invites the individual teacher to personalize the narrative: in other words, the success of the *Standards* is based on the extent to which the individual teacher identifies with the author. As the *Professional Standards* put it: "Teachers are key figures in changing the ways in which mathematics is taught and learned in schools" (2). Since the *Professional Standards* are vignettes that are meant to be personified, we must classify the effectiveness of the narrative by examining the duality of narrators. In other words, to what extent do the thoughts, desires, and goals of the NCTM and its readers coincide?

The NCTM *Standards* can be viewed as a conversation between the text and the local teacher. Since the *Professional Standards* are an advisory text, they engage in a "permutation and alternation of roles between tellers and listeners" (Maclean 125). This conversation, though, is admittedly incomplete because the *Professional Standards* is an analytic narrative. The analytic narrative leaves "multiple gaps left by its fragmentation and incompleteness" (Maclean 143). Analytic narratives differ from other narratives because they primarily function on the level of *logos* and reasoning. They try to build a case for a position as well as telling a story or a series of stories to support
a particular worldview. This leads to a problem: because there are three different narrators, there will necessarily be gaps in and different assumptions underlying the narrative. The question that must be answered is whether these gaps detract from the acceptance of the text. As I shall argue in the remainder of this chapter, the choice of the analytic narrative form by the NCTM is a vital reason for the *Professional Standards* not yet being accepted on a wide scale.

**The Conversation Between the NCTM and the Reader:**

Given the metaphor of a conversation, we have a dialogue between the author, the NCTM, and the individual teacher who reads the *Professional Standards*. In the NCTM's view, the individual teacher plays a very minor role in the dialogue. Ronberg notes that teacher autonomy should be considered as a secondary goal within mathematics education reform. As he states, "The reform vision sees as the norm a balanced curriculum arrived at via teacher collaboration, joint planning of lessons, and shared judgments about student performance" ("NCTM's Standards" 39). Thus, the role of the individual teacher becomes subjugated to the role of groups of teachers organizing and sharing experiences. Thus, the conversation metaphor should be properly termed as between the NCTM and small groups of teachers. In the eyes of the NCTM, reform happens only when entire schools are caught up
in the vision of the *Standards*. Thus, the goal of the narrative is to encourage multiple teachers to accept the NCTM's vision of mathematics education.

However, the NCTM still needs to have individual teachers accept the narrative, and thus, vignettes dominate the text. The vignettes try to bridge the gulf between the NCTM and the individual reader by featuring teachers who tell their thoughts and stories. This approach fails for two reasons. First, it is difficult to integrate multiple voices into an analytic narrative. The NCTM chose to keep a consistent voice, rather than let the vignettes be told by the individual storytellers. The NCTM uses the examples of other teachers and educators always in the third person—refracted through the narrators, or the working groups of the *Professional Standards*. The text never offers a vignette in the first person, but instead uses external focalization, an impersonal form of narration that is the act of placing characters in the narrative such that they do not see, but rather are seen (Genette 72). This authorial decision is significant because it breaks one of the ways in which a bond can be established between the author and the reader. As Wayne Booth explains, "Impersonal narration may, in fact, encourage the very subjectivism that it is supposed to cure" (83). While the NCTM tries to make an objective case for the *Standards*, the text encourages a subjective reading.
Booth's statement forces us to consider the author's authority: if we do not like or trust the author, we will not take the author's advice. The form of the narration—omniscient narration—is a rhetorical choice that leads to further problems in accepting the narrative. Not only is omniscient narration not used in modern works, it is distrusted by the audience. The NCTM is thus left with a dilemma. While the NCTM wants to allow schools and teachers to have some ability to adapt local curricula, the NCTM wants to constrain the range of allowable types of curricula and teaching in order to uphold the spirit of the Standards. The voice of the narrative precludes its bonding.

This leads us to the second problem with the Professional Standards—the Standards are an analytic narrative. Analytic narratives rely on logic and concrete data to generate a conclusion, and as a result, provide a "belief of objectivity." The NCTM is forced to demonstrate its expertise throughout the narrative, and one of the best ways of doing this in the analytic form is to present research data supporting the Standards. The problem is that the NCTM had little empirical data in order to justify its conclusions. As a result, the NCTM had to rely on subjective experiences in order to support its objective conclusions. The NCTM consequently adopts the "priestly voice" in order to make its case. The "priestly voice," or "expert rhetor" must use subjective experiences along with logical forms in
order to enhance the rhetor's expertise. Thus, the NCTM must adopt a priestly voice of expertise within an analytic form, creating a rhetorical tension that is ultimately unresolved. We will return to this point later in the chapter.

The Narrative Conversation:

In addition to examining the participants in the conversation, we must also consider the nature of the conversation. In other words, we must ask whether the conversation is relatively complete and takes place between equals. Inevitably, every conversation has "multiple gaps left by its fragmentation and incompleteness" (Maclean 143). One of the effects of Maclean's view is that narrative is often broken into a series of small plot lines. In order to bring a sense of completeness to the narrative, the rhetor must consciously try to bring the subplots to a conclusion. In the Professional Standards, these plot lines are linked through the annotated vignettes as well as the conclusion. Many teachers, however, may wonder how the material they read in the first chapter relates to what they read in the third chapter. Because the story is broken, the conversation is disjointed. The NCTM tries to remedy this problem through a concurrent narrative, a narrative where the narrators confirm the same story (Coste 173). The NCTM accomplishes the confirmation through a series of tables in the third chapter. For example, the fourth standard in chapter three, "Knowing
Mathematical Pedagogy," is cross-referenced to the 19 vignettes of chapter one (159). This approach attempts to show the coherence of the narrative, yet also vividly illustrates the narrative's problem: if we are forced to use tables as the test of coherence, we must conclude that the analytic narrative of the Professional Standards has too many gaps to create a coherent telling of the NCTM's narrative. If the narrative were complete, the NCTM would not have the need to highlight its links.

The fragmentation of the narrative means that the message cannot adapt to the audience's needs. The second section of the text offers an illustrative example: "A consistent message throughout the standards for the evaluation of teaching is the importance of teachers being reflective about their teaching and working with colleagues and supervisors to improve their teaching" (119). The problem with this message is that teachers aren't given a clear direction by which they could analyze their teaching; rather, the highly stylized form of the narrative prohibits this section from showing any concrete examples of reflective teaching. The teacher must look to other vignettes to indirectly gain insights into reflective teaching.

This problem occurs again in the same section of the text. The following represents a portion of a vignette along with the annotation that accompanies it:
Vignette: "The university students observe the way the teacher engages the students."
Annotation: "The university students are impressed with how the teacher supports students in validating a conjecture" (118).

The problem is that since the text never tells the reader the way in which the teacher engages the students, we do not understand how the annotation follows from the vignette. We must take the NCTM's word for what happened in this particular classroom. Instead of actively participating in the narrative, the reader is constantly reminded that they are reading a highly edited narrative.

This is also not a conversation that takes place between equals. Rather, as a supposedly well-informed instructional source, the NCTM must sustain an element of superiority as a member of the elite. As Lessl notes about expert discourse that is addressed to the public realm, elites bring "interpretations of established theory and method to the general community, serving the rhetorical purposes of the scientific community" (186). Thus, the NCTM Standards translate the theory of the professional educator into a discourse suitable for use by K-12 teachers, as well as the interested lay audience.
Unpacking the Assumptions of the *Professional Standards*:

Our next task is to identify the implicit and explicit assumptions of the *Professional Standards*. The NCTM claims the *Professional Standards* are based on two assumptions: that teachers are key figures in "changing the ways in which mathematics is taught and learned in schools" and that changes require "long-term support and adequate resources" (2). The first assumption is more significant. The assumption is fairly obvious, but the way in which the NCTM arrived at its conclusion is worthy of analysis.

A narrative is created by a series of philosophical choices, which as Lanser points out, are related to the author's world view. In the case of the *Professional Standards*, the first choice is to identify the *Standards* with cognitive psychology. American educational psychology has shifted from behaviorist theories to cognitive theories, and mathematics education has joined in the movement. As Thomas Romberg asserted, "Virtually all cognitive theorists share the fundamental assumption that an individual's knowledge structures and mental representations of the world play a central role in perceiving, comprehending, and acting" (473). Indeed, many of the articles supporting the *Standards* refer to some kind of cognitive framework. The *Professional Standards* argued that "Each student's knowledge of mathematics is highly personal" (2). As a result, the role of experience is highlighted still further in the text.
Indeed, it forces the NCTM to argue that "Mathematics instructors do not simply 'deliver' content; rather, they facilitate learners' construction of their own knowledge of mathematics" (127). The philosophical choices of the NCTM force the text into further attacks of the traditional position. Because the cognitive framework is greatly opposed to the traditional model, traditional teachers must be attacked frequently in the text.

The attacks on mathematics teaching are most evident in the standard on experiencing good mathematics teaching. The NCTM boldly attacks the traditional teacher's reliance on the lecture by a series of citations of university and other teachers. At one point, the NCTM uses a university mathematician to state the case: "You know, [lecturing] really isn't [important] anymore, and it doesn't seem to be really important to my students" (128). Indeed, the Professional Standards encourage group work as well as the use of computers to stimulate learning.

The vignettes make this point clearly, using the university classroom as well as the K-12 classroom. In the third vignette, we see an associate professor change her ways:

"I don't believe that I'll ever go back to my old ways of teaching undergraduates. I used to spend most of my time presenting formulas and going over homework. My students used to repeat back what I taught, always seeking the quick rule. Now after a quick introduction to a new topic, Bill and I focus on problem solving" (131).
The next standard further attacks the traditional position, arguing for the students to work in groups instead of in isolation. The NCTM uses several citations from a book entitled *Making Connections* to state the case for group learning. The citations are telling: "There is as much learning that takes place in the small groups of two or three as there is that takes place at the individual desk" and "I do think that a rigorous proof can be worked out by a group of students working together" (133; citing Gilligan, Lyons & Hammer 294-295).

The NCTM clearly hopes that the traditional teacher is convinced that her or his pedagogical style will be radically altered as a result of reading the *Professional Standards*. The problem is that no empirical data is given to support the conclusion--indeed, little data exists that could justify the conclusion. The NCTM is thus forced to incorporate testimony from other "believers" into the priestly text.

The cognitive stance of the *Professional Standards* is further developed in the belief that "learning occurs as students actively assimilate new information and experiences and construct their own meanings" (2). Learning is the active construction of knowledge, one of Romberg's points. The NCTM encourages this viewpoint through a variety of alternative teaching strategies, many of which are no doubt foreign to the traditional teacher.
The Opening Vignette: Énunciation of the Professional Standards:

Now that we have dealt with the assumptions of the narrative, we can begin by examining the opening vignette. It is vital because it is a representative anecdote. The opening vignette has three important characteristics: there is tension between characters, it emphasizes the importance of setting, and it is highly self-referential.

Any narrative must somehow create a sense of drama and conflict. The first vignette does this by introducing the device of adding another character, most often a fellow teacher, but sometimes a principal or rarely, a college professor. The role of the second character in the vignette is to provide direction and guidance into the first character's content and pedagogy. This serves two rhetorical functions. First, it further refracts the teacher in the vignette, thus minimizing the initial teller of the vignette. As a result, the second character, who espouses the NCTM position, takes on greater importance. Sharon asks how to start the new year, and the second teacher, Tom, reaffirms and guides Sharon's decision. The vignette itself reinforces the importance of this interaction: "And [Sharon] is glad that Tom wants to work on this too--it will really help to have someone to talk to" (15). The implication is twofold: first, the Professional Standards will be accepted only when large numbers of teachers are adopting it, and second, that the NCTM position is reinforced through authority figures.
Despite the narrative's insistence that university professors are colleagues of K-12 teachers, there is still a hierarchy that exists—the K-12 teachers are unequal colleagues.

This notion is reinforced through the setting of the vignette. While it deals with a practicing K-12 teacher, the university community is also involved. The first vignette shows Sharon Robinson, a sixth grade teacher, looking over her materials from a master's level course in mathematics education. The vignette includes some refraction and self-analysis, but always filtered through the corporate narrator: "Sharon was troubled about her students' participation in, and success with, mathematical reasoning and problem solving" (11). This use of the third-person strategy forces all experience to be interpreted in the light of the Standards so that any contradictory conclusions will be eliminated.

The vignette is also self-referential: there are countless references to the Curriculum and Evaluation Standards. In the vignette, Sharon is writing a letter to her students' parents, and the text specifically highlights the fact that Sharon "will refer to the Curriculum and Evaluation Standards (emphasis added)" (15). The vignette also mentions that in Sharon's summer class, the teachers became familiar with the Curriculum and Evaluation Standards.

Additionally, the vignette recognizes the need to mollify an outside authority, a structural device that runs through many of the vignettes. In the first vignette, Sharon
has to please both the principal and the parents. She is worried that the principal will find her class too loud and talkative if she lets the students work in cooperative groups. She also recognizes that the parents are concerned about placement test scores, and that her untraditional methods may not necessarily correspond to achievement test items (14). Sharon is even concerned that the students will not know how to handle the types of questions she plans on asking: "What do you all think about what so-and-so just said?" (14).

As we have seen, the annotations in the vignette serve as a literary device to tell the reader what will be coming; for example, "How teachers can support one another's professional growth is a continuing theme in this volume" (12). The theme of support and unity runs through many of the annotations. The Standards are not an individual exercise; the maximum benefit occurs only when many teachers are following the Standards.

Moreover, the annotations serve an organizational function by making references to specific sections in the text: "This is explored in the teaching section," and "Aspects of this idea are discussed in the Professional Development section" (13). This organizational function also contributes ideologically to the vignette. The first vignette offers some insight into what is valued in the Professional Standards. One annotation declares, "All
sections stress the importance of teachers paying attention to students' knowledge and their ways of thinking about mathematics" (12). This in itself offers little in profound insight; most teachers are naturally concerned with their students' knowledge and how students solve problems. The implicit view, of course, is that the Professional Standards are the best means by which teachers pay attention to the way their students think about mathematics. The question we must ask as rhetorical scholars is why the designers of the NCTM Standards felt they had to restate an obvious truism. Narrative theory suggests two reasons for this. Coste argues "there is no narrative discourse without repetition" (37). We know that within the innovational movement, key words and phrases must be agreed upon by members of the group. Repetition serves as an important unifying tool. As Booth suggests, "the author cannot count on such general agreement to be lively enough for his purposes" (177). The provocative idea of Booth's is that the agreement must be lively. The NCTM seeks to adopt standards that are not universally accepted. One of the purposes of the repetition is to encourage dialogue among those who already share the philosophical assumptions. It encourages people to write about the Standards in other forums. In addition to the NCTM's journals, there are many educational and mathematics journals that now feature Standards articles. Researchers
use the agreement to spark new articles about the Standards. As a result, the Standards take on greater importance.

The continual repetition is a device the NCTM uses consistently in the Professional Standards. As an example, the NCTM defines "every student" several times. The definition itself is nearly a quarter-page long, and includes "students who are female as well as those who are male" and "students who have not been successful in school and in mathematics as well as those who have been successful" (72 and others). Basically, everyone will either be male or female; this is no new revelation from the NCTM. Yet, the phrasing helps open the dialogue: what can the NCTM do to encourage more female involvement in mathematics? How do we help the at-risk learner? This strategy allows the NCTM to build from relatively simple claims to more provocative claims later in the text, and further encourages articles that investigate the "truisms". Indeed, the NCTM's journals have featured several articles about at-risk students, and the question of females in mathematics has been visited many times.

The First Narrator: Standards for Teaching Mathematics:

The first vignette is part of a larger whole created by the first narrator, the working group for the standards of teaching mathematics. The first section of the Professional Standards is an examination of the tasks, discourse,
environment, and analysis necessary to have a Standards classroom. This section of the Professional Standards refers extensively to the C&E Standards.

The C&E Standards are further developed and made more concrete by the Professional Standards. The Professional Standards define the C&E Standards as being concerned with reasoning, problem solving, communication, and connections (19). The C&E Standards are also described as interested in teaching: "it suggests changes in not only what is taught but also how it is taught {emphasis in original}" (20). The role of this section of the narrative, then, is to make the claims of the C&E Standards explicit. The lead narrator of this section is Deborah Ball, cited earlier in this chapter. Ball's work tries to "move the discourse boldly behind the proverbial classroom door and provide new directions in content and approach" (Ball 1).

In regard to their students, teachers are called upon to recognize their diversity. The example, though, is based strictly on gender: the teacher is asked to deliberate systematically whether or not a task is more advantageous to men or women (27). Other elements of diversity, such as cultural heritage or other background, are missing. Thus, the diversity the NCTM seeks is only partially successful.

Three vignettes accompany the first teaching standard. The first vignette simply relates two different types of mathematical problems, one which asks students to simply
recall information, while the other forces students to think of alternative solutions. The explanation of the second problem is far longer than the problem itself. This amount of explanation serves to reify the type of problem the NCTM would like to see in classrooms: open-ended, slightly ambiguous problems.

The second vignette is more interesting; it relates the story of a first year teacher who is forced to use a textbook that she does not like. It is quick to chastise textbooks that rely on procedural mechanics. The vignette notes, "She doesn't see anything in the task that would emphasize the value of understanding why, nor that would promote mathematical discourse" (29). Yet, we do not see the problems in question; in fact, all we are told is that there is a picture at the top of the page of 24 ¼-inch beads and 48 ¾-inch beads. Thus, we are forced to accept the NCTM's version of the problem, because they are the omniscient narrator. We assume their analysis is correct because we have no basis by which to reject that analysis. This example of selective omission is important because it is a device used by the NCTM to heighten their status.

The third vignette differs from most of the vignettes in that it never mentions a teacher's name--the teacher is always referred to as "the teacher" or "she." This has the effect of emphasizing the teacher's performance and identifying specific behaviors with a generic teacher instead
of with a named person; The text seeks to respond to the potential objection of "Ms. Jones can do that, but I may not" by emphasizing that the behaviors of the vignette should be practiced by all teachers.

Also, the third vignette notes the changing role of the teacher and the student in a Standards classroom: "The teacher deliberately leaves the question unanswered. She wants to encourage them to persevere and not expect her to give the answers" (31). The teacher is but one participant in the discourse. Additionally, however, it again brings up the issue of ambiguity: problems may not have easy solutions, and it is up to the students to discover if the ambiguity can be resolved.

The second standard for teachers is discourse. The Professional Standards define discourse as "the ways of representing, thinking, talking, agreeing and disagreeing" (34). Clearly, to a rhetorician, this is a simplistic definition of discourse, as we talk about discourse systems. Yet, the definition serves to ground the study of discourse in very practical terms for mathematics educators.

In the background to the second teaching standard, the NCTM chose not to identify one of the classic works on teacher-student discourse in the mathematics classroom: James Fey's work published in 1970. The 1970 book draws the same conclusions as the text: "When the teacher talks most, the flow of ideas and knowledge is primarily from teacher to
student" (34). The reason I am highlighting this lack of evidence is because Fey's work highlights the true nature of the problem: the problem is not just that teachers talk more than students, but that the patterns of discourse that are prevalent in the mathematics classroom—structuring, responding, and reacting, are what hinder learning.⁸ Students can talk more than the teacher and still not engage in productive learning. For example, the first vignette shows students making a series of suggestions without offering any explanations (38). The vignette uses a common discourse pattern of the teacher asks a question, followed by a student's response, followed by the teacher reacts to the response. Instead of being transformational, the vignette is actually typical of classrooms today.

The metaphor the text uses to describe classroom discourse is a piece of music with themes that pull together in order to create meaning (35). One of the themes that is repeated in the vignettes is "Why?" The question is meant to be asked about both correct and incorrect answers. The "Why?" question is designed to introduce other students into the conversation and elicit their reactions (37).

Students' role in discourse is the third teacher standard. The elaboration of this standard is minimal: the basic point of the standard is that students should be responsible for much of the discussion in the classroom. The first vignette is atypical in that it demonstrates a
classroom that is not yet used to the Standards. One of the weaknesses of the vignettes is that they assume that classrooms are already in the Standards mold, and do not show a teacher how their classroom can become like those of the Standards. The vignette is set in a sixth grade classroom.

One of the annotations of the vignette is repeated at various points in the Professional Standards: "This student already assumes that justifying her answer is part of giving it" (46). This becomes an important theme in the Professional Standards. It moves the students to the center of the narrative, and their explanations and stories are often more important to the text than the teacher's explanations. Indeed, an annotation in the next vignette underscores student discourse: "The students communicate with one another about mathematics without the teacher asking them questions or directing their comments. They also use mathematical language developed through the discourse" (48).

The fourth teaching standard identifies tools for enhancing discourse. Rhetorical tools are called for in this standard; the text suggests that metaphors, analogies and stories are acceptable in order to enhance discourse (52). Yet, in the two vignettes, there is no mention of metaphors, analogies or stories. Indeed, in this standard, the vignettes are seemingly out of place, and do not support the standard's ideal. The standard calls for a variety of tools by which mathematical discourse can be enhanced. With the
exception of alternative symbols in the first vignette, there is no illustration of different and unusual mathematical tools. This portion of the narrative, then, is largely unsubstantiated. In a sense, this standard could have been the most interesting for communication scholars and the most informative for teachers of mathematics, but instead, it highlights the gaps present in the analytic narrative form.

The last standard in this section, the analysis of teaching and learning, highlights the connections between the **Professional Standards** and the **C&E Standards**, and briefly attempts to draw parents into the text. The annotations mention specific pages in the **C&E Standards** as a reference. The third vignette highlights a parent-teacher conference in which the NCTM reports the parent's response: "Mrs. Byers finds all these specific examples very useful and comments that she thinks what Ms. Lundgren is trying to do in math is great and she wishes she had had a mathematics class like this when she was in school" (66). We see another example of the highly stylized vignette form, one that serves the rhetorical function of inclusiveness.

**The Conflict Continues: Transformational or Innovational?**

As we saw in chapter three, the **C&E Standards** revealed conflicting transformational and innovational elements. This same problem holds true in the **Professional Standards**.
The Professional Standards clearly attempt to be transformational in their approach, especially in the section on the teacher's role in discourse. The traditional teacher is attacked extensively in this section. As the standard notes, "Instead of doing most of the talking, modeling, and explaining themselves, teachers must encourage and expect students to do so. Teachers must do more listening and students more reasoning" (36).

In many other places, however, the NCTM sees the Professional Standards as valuable for major shifts in thinking. With regard to alternative certification, the NCTM states that "These Professional Standards will provide guidance for such induction and licensure programs" (190).

The NCTM's Second Attempt at Transformation:

The NCTM's attempts at making the Professional Standards a part of an innovational movement are made more difficult because of the radical breaks in teaching and pedagogical practice that the NCTM advocates. In short, the Professional Standards are a more radical document than the C&E Standards.

Gone from the Professional Standards are the beliefs that change will occur over time. Rather, the C&E Standards are reinterpreted in a more radical light: "the C&E Standards implies a significant departure from the traditional practices of mathematics teaching" (emphasis
mine; 20). Indeed, the *Professional Standards* call for teachers to be "impatient enough to take action" (194).

As Smith and Windes put it, the innovational movement's spokesmen do not want to call attention to division (143). Yet, the last portion of the *Professional Standards* highlight division. As the support standards note, "Existing support systems for mathematics teachers are as inadequate for teaching in today's society as the shopkeeper arithmetic curriculum is for educating children to live and work in the twenty-first century" (177). The problem is that a significant portion of the *Professional Standards* is targeted to this audience. The supervisory personnel will say, "We cannot do anything about the problem of support given our budget," and thus, will not be likely to take the NCTM's advice. Additionally, the NCTM's directions in this area are lacking; their solution is to give teachers more money, more time for planning, and more technology, a view at odds with many in policymaking positions. One of the peculiar problems with these standards is that the collegiate mathematics education community is not called to encourage students to learn about the *Standards*.

The second task an innovational movement must accomplish is to emphasize the weakness of traditional institutions and the strength of traditional values. In other words, "advocates must criticize institutions and point to areas of critical failure" (144). Here, the NCTM strongly attacks
traditional institutions, arguing for "changes in the basic structure of schools" (190). The failures occur on several levels. The NCTM notes that class periods should change, with students meeting less often but for a longer period of time (190). The problem is that none of the failures are posited to be critical, but rather, are symptomatic of other problems in the educational system.

Responsibilities: Can the NCTM Share the Load?

The NCTM clearly realizes that they cannot support the Standards alone. Indeed, any movement must somehow gain the support of others in order to succeed. The final area the Professional Standards addresses is the responsibilities other groups have in the success of the Standards. One of the groups the NCTM targets is textbook publishers. The NCTM argues that "textbooks and texts have a profound influence on what is taught. Therefore, authors and publishers have both an opportunity and responsibility to improve mathematics education" (179). The NCTM is not being completely realistic, however, as state curriculum committees often decide which textbooks are usable and which are not. The NCTM must somehow convince these committees that change is necessary before they can work on the level of the individual teacher.

The NCTM also encourages business and industry to become involved, allowing their workers to spend time in classrooms.
The only problem with this idea is that these outside workers might still be using traditional mathematics, which would be in contradiction with the Standards.

Resolving the Narrative Paradox:

The NCTM had to resolve two major paradoxes within the Professional Standards. First, they had to be inclusive of laypeople and business professionals who could help their cause while at the same time maintaining their elite standing in the educational environment. Additionally, the NCTM had to rally the support of teachers already committed to the cause of the Standards while at the same time persuading traditional teachers to adopt the Professional Standards.

One of the ways of resolving the paradox is through narrative. The NCTM was interested in persuading new audiences to accept the Standards. To adopt the Standards, especially the Professional Standards, requires a major shift in a teacher's paradigm. As Macintyre notes, "When an epistemological crisis is resolved, it is by the construction of a new narrative which enables the agent to understand both how he or she could have intelligibly held his or her original beliefs and how he or she could have been so drastically misled by them" (56). Deborah Ball notes the efforts of the NCTM to resolve the paradox within the Professional Standards. Ball is particularly suited to identify the problems of the Professional Standards because
she was one of its major writers. Ball muses, "The ideas contained in the draft [of the Professional Standards] had to inspire both new thinking and the concurrence necessary for significant change to occur" (3). This is a highly difficult rhetorical task. One way of resolving the conflict is also mentioned by Ball: minimizing expectations. In her view, "The Standards represent a banner, not a dogma" (Ball 4).

Another method of dealing with the paradox is suggested by Joan Ferrini-Mundy and Loren Johnson, who see the Professional Standards as a polyglot narrative, written as a series of multiple narratives with multiple interpretations (Ferrini-Mundy and Johnson 190). In other words, the Professional Standards mean different things to different people.

The NCTM Standards do not resolve the epistemological crisis adequately because it does not meet Macintyre's criteria. One of the paradoxes is that while the NCTM seeks multiple interpretations of the Standards, these interpretations are confined to a limited space. The NCTM supports only those interpretations where "the total environment in which teaching and learning takes place [is] reformed" (189). In other words, one cannot use the Professional Standards to engage in incremental reform. The repudiation of past traditions in favor of the current tradition is necessary, for as McIntyre contends, "A tradition then not only embodies the narrative of an
argument, but is only to be recovered by an argumentative retelling of that narrative which will itself be in conflict with other argumentative retellings" (63).

The NCTM As Expert Rhetor:

Because the NCTM is an advocate of complete reform, the NCTM is able to adopt the an expert persona for mathematics education. This is not an option open to innovational movements, but only to those movements who agitate for change. As Lessl notes, the expert who addresses the public "speaks on behalf of an elite subgroup of society and bears responsibility for making its esoteric concepts meaningful" (185). In this case, the NCTM is the elite subgroup of mathematics teachers responsible for encouraging mathematics reform. The NCTM reaffirms that role as it notes, "These Standards documents are the consensus of the mathematics and mathematics education communities" (192).

As we mentioned in the previous chapter, the NCTM ultimately has to convince traditional teachers to fall under its paradigm. As discourse designed to enhance the expertise and status of its novice audience, the NCTM must remind "people of what they might become, attempting to change the identity of its intended audiences by nudging them gradually into the symbolic environment of an elite social group" (Lessl 188). The Professional Standards are a vivid example of Lessl's view. One of the important aspects of this kind
of technical rhetoric is that it is exhortative. While the overall tone of the Professional Standards is one of radical reform, somehow the text must encourage the traditional teacher to change teaching practices.

One of the ways the text tries to do this is through highlighting different ways of handling homework. In one vignette, four different ways of reviewing homework are discussed. This allows the NCTM to show changes in teaching practice while at the same time offering practical suggestions for teachers that appear reasonable. In fact, the Professional Standards are filled with a variety of problems and examples for teachers to try, problems which have ostensibly been tested in Standards' classrooms. The gentle reminder is that teachers who use these type of problems on a daily basis, and change their behaviors in ways prescribed by the text, can become Standards-influenced teachers.

One of the consequences of an exhortative movement is that it takes on qualities of fundamentalist rhetoric. Indeed, the Professional Standards are meant to be taken as gospel: "This document spells out what teachers need to know to teach toward new goals for mathematics education and how teaching should be evaluated for the purpose of improvement" (vii). Thus, a tension emerges between gentle changes and fundamentalist fervor.
Conclusion:

The NCTM provides a series of standards made palatable to the reader through the use of annotated vignettes, or small narratives. We must be careful, however, about the use of annotated vignettes. Booth notes that the widespread use of annotated narrative summaries can detract from their usefulness in the reader's mind unless "the author retains some method of showing what the facts are from which the speaker's interpretations characteristically diverge" (175). Booth's comment suggests one of the basic weaknesses of the Standards: its lack of a research base ("NCTM Curriculum" 339). Just as in the Curriculum and Evaluation Standards, very little support is offered in the text for the reasons for the Professional Standards.10

The NCTM desires several outcomes from the Professional Standards. First, the proper evaluation of teaching will lead to increased professionalism among mathematics teachers. If anything, the Professional Standards are designed to be a blueprint of how to market the discipline so that teachers are not only held more accountable for what takes place in their classrooms, but also reap the rewards when students' performance improves. Second, the Standards are designed to help college professors so that preservice and inservice training will improve. The Professional Standards are designed in part to be read by preservice teachers so that they can understand what mathematics classrooms should look
like. The fact that many first and second-year teachers are included in the vignettes reaffirms the notion that new teachers are capable of meeting the challenges of the Standards. Classrooms as well as content are supposed to change after applying both volumes of the Standards. Indeed, there is a sort of "before" and "after" perspective established. The teacher before using the Standards sees the classroom as a collection of individuals, rather than as a mathematical community. The "before" teacher also sees herself or himself as the sole authority for the right answer, instead of logic and mathematical evidence as verification for a student's ideas. The Professional Standards also suggest that teachers who follow the Standards encourage their students to reason mathematically instead of memorizing procedures, conjecture instead of using mechanistic methods, and look for the connections in mathematics as opposed to mathematics as a series of isolated concepts. The old ways of teaching mathematics are not satisfactory, and students as well as teachers need to expect change (Richardson). Teachers, though, are fairly resistant to change.

Finally, the Professional Standards also seek to shift some of the responsibility away from teachers and toward schools, colleges, and policymakers. Recognizing the teacher's need to improve, the NCTM argues that improvement
can best occur when schools, school boards, and others all support the unified notion of the Standards.

The NCTM believes that a Standards classroom is easily recognizable such that any teacher should be able to identify a Standards classroom. Where the Professional Standards is weakest, however, is in explaining how one's classroom becomes a Standards classroom. Most of the vignettes take place in classrooms that have already been trained in the Standards mindset. We do not see how the classrooms were trained, or how long the training lasted. The issue of how to train a student to behave in appropriate ways is largely missing from the Standards.¹¹

Many of the writers involved in the Professional Standards share the sentiments of one mathematics education professor, who noted, "For many of us, implementing the Professional Standards for Teaching Mathematics in our classrooms makes great sense" (Vace 88). The problem was that the narrative was not yet complete. Teachers would also have to make changes in the way they assess their students, which will be covered in the next chapter.

Notes:

1. When the Professional Standards came out, new members of the NCTM could receive them for $10.00, a 60% discount over the usual price of $25.00. Members of the NCTM prior to March 1, 1991 received the Professional Standards for free.

2. There are a few studies which fit into traditional social scientific paradigms. These are published infrequently in the Journal for Research in Mathematics Education. However,
the other three NCTM journals (Mathematics Teacher, Teaching Children Mathematics, and Mathematics in the Middle School) all utilize the experience-based format. Thus, it is impossible to separate experience from the narrative form, and indeed, pedagogical theory suggests that one cannot do so.


4. This is tied into the notion of expertise in rhetoric. We believe that someone is objective in part because of their expertise, particularly in scientific fields. See John Lyne and Henry F. Howe, "The Rhetoric of Expertise: E.O. Wilson and Sociobiology." *Quarterly Journal of Speech* 76.2 (1990): 134-151.

5. The remainder of the dissertation will use the term "expert rhetor," in keeping with the spirit of Lessl's essay.

6. In the postmodern perspective, this is similar to finding the "grand narrative" that Lyotard describes.

7. My argument in chapter one was that for our purposes, mathematics is analogous to science as far as a technical rhetoric is concerned.

8. This point was illustrated in the author's 1989 essay, "An Analysis of Teacher-Student Communication in the Secondary Mathematics Classroom" (Paper presented at Speech Communication Association, Atlanta, 1989). The paper confirmed Fey's findings by showing the dominant form of teacher-student interaction was a teacher's question followed by a student's response and then a teacher's reaction. My difference here with the Standards is that the Standards claims this type of interaction should be avoided, while I contend that it should be used in moderation.


10. Various authors have tried to remedy this problem after the first two volumes of the Standards were published. My point here is that the Standards came first, then the research.

11. One could certainly argue that the Standards should not tell a teacher how her or his classroom should operate. At the same time, teachers must have some idea as to how to
make their classrooms *Standards*-friendly, otherwise the *Standards* would be incomplete.
Introduction:

One of the problems of the first two volumes of the NCTM Standards is that teachers had little vision for how to test their students. Given that the first two volumes of the Standards called for great changes in the classroom and in pedagogy, there had to be new ways of measuring student performance. In 1992, shortly after the Professional Standards were released, the NCTM commissioned a working group to study ways of helping teachers develop new assessment techniques. Many of the members of the working group contributed to the 1993 NCTM Yearbook on assessment.

The Assessment Standards are the final part of the NCTM Standards, and were written to "complement" the other two volumes of the Standards. They are considered by the NCTM to be valuable; "Unless we implement new assessment principles, we will fall short in achieving the visions of curriculum, evaluation, and teaching expressed in the previous Standards" (8). The NCTM strongly encourages districts and teachers to use the Assessment Standards, even in the working draft: "The teaching and learning of mathematics, as expressed in the Curriculum and Teaching Standards, depend on the development of assessment systems..."
based on the values and goals reflected in these Assessment Standards" (7).

To this point, the Assessment Standards has received comparatively little attention in the NCTM journals. They are, however, worthy of our attention for two reasons. First, the Assessment Standards is an exemplar of reforms already made in several states, such as Vermont and California. In Vermont, for example, students in the fourth and eighth grade must turn in portfolios of their work. The Assessment Standards highlight those reforms and encourage other states and districts to follow more extensive reforms. Additionally, the Assessment Standards serve as further help for individual teachers. The Assessment Standards believe that "teachers and others need guidance and models of assessment to inform their practice" (6). Accordingly, the Assessment Standards is a model for both school districts and individual teachers to follow. The Assessment Standards are similar to the C&E Standards in that both teachers and districts are to implement each volume. The reforms of the C&E Standards and the Professional Standards would not be complete without changes in assessing student performance, for as the NCTM notes, "The teaching and learning of mathematics, as expressed in the Curriculum and Teaching Standards, depend on the development of assessment systems based on the values and goals reflected in these Assessment Standards" (7). Indeed, the NCTM makes the Assessment
Standards very important: "Unless we implement new assessment principles, we will fall short of achieving the visions of curriculum, evaluation, and teaching expressed in the previous Standards" (8). Clearly, the Standards must address the issue of student evaluation and testing, and the Assessment Standards were written as a response.

The NCTM also used the Assessment Standards as an opportunity to respond to critics who felt that previous volumes of the Standards had too few K-12 teachers involved in the creation of the documents. The Assessment Standards claim the authors include "predominantly K-12 teachers" (2). A cursory look at the author page lends some credence to the NCTM's statement, in that K-12 teachers are more represented than they are in the other two Standards documents. There are 18 people who worked on the Assessment Standards, and only six of the 18 are from colleges and universities.

The Assessment Standards are a hybrid of vignettes and text, with the text and vignettes alternately dominating. However, the Assessment Standards adds the rhetorical form of the letter. The letter has been used as an object of rhetorical analysis previously, and will be briefly mentioned. Accordingly, I will examine the assumptions of the Assessment Standards, and then assess their success.
The Assumptions of the Assessment Standards:

Before we can examine the assumptions of the Assessment Standards, we must first define "assessment," as it is a key term throughout the text. The NCTM argues that assessment "is the process of gathering evidence about a student's knowledge of, ability to use, and disposition towards mathematics and of making inferences based on that evidence for a variety of purposes" (6). The definition offered stands in need of further clarification. In essence, the NCTM is responding to major standardized tests; the NCTM believes they are poor at assessing students' knowledge of mathematics.

Indeed, assessment becomes more than just a tool for finding out about students--assessment becomes the "god term" of the text. The NCTM continues by arguing that assessment is connected with instruction (6). Further, "assessment should be seen as an integral part of instruction that encourages further learning" (11). For the NCTM, assessment is only successful when students learn by being assessed and through self-assessment.

In fact, the C&E Standards are linked with the Assessment Standards: seven standards found in the C&E Standards "should be considered an elaboration of the conception of mathematics implied in Assessment Standard #1" (11).
Explicit Assumptions of the Assessment Standards:

One aspect of the Assessment Standards that differs greatly from previous volumes of the Standards is the number of assumptions that are explicitly highlighted in the text. The Assessment Standards highlight ten different assumptions, which fall into two categories: assumptions about mathematical learning and assumptions about assessment. I will discuss these assumptions, for they are vital to understanding the reform vision, as well as their meaning.

The first of the NCTM's assumptions about mathematical learning is that every student is capable of achieving mathematical power. This is not a new assumption, since it is the same assumption of the C&E Standards and Professional Standards. It serves to illustrate the links between the three Standards volumes.

The NCTM also makes the assumption that mathematics is a socially constructed body of knowledge. This particular philosophical assumption is important because it ties the Standards project to the constructivist movement, and will be described in more depth later. The NCTM contrasts the social construction of knowledge to behaviorism, arguing against the theory that the mind is like a sponge that absorbs knowledge (12).

The third learning assumption is that teaching is an activity involving both guiding and challenging students as they investigate problem situations. All students are to be
challenged, instead of just a select few. Finally, the NCTM sees learning as an active, exploratory process involving the reinventing by students of key mathematical concepts.

The NCTM then offers a series of assumptions about assessment, which are asserted at the beginning of the text. The first assumption is that evidence about student mathematical performance is needed for a variety of purposes. For example, evidence can be used to report to administrators how well students are doing in a classroom, or to parents who wonder how well their child is doing. The NCTM argues that the type and quality of evidence varies with each purpose and with the consequences for students related to each purpose.

The second assumption is that information about student performance needs to be collected from multiple sources using a variety of methods and formats. This simply means that interviews, projects, portfolios, and other methods are acceptable.

The third assumption is that the evidence a teacher gathers about a student must be considered a sample of all possible evidence. This represents a break from tradition, which relied heavily on tests, quizzes, and homework as a gauge of a student's performance.

The fourth assumption is that teachers are the primary assessors of student performance. This view stands in stark contrast to the view that norm-referenced tests are valuable assessors of student performance.
The most radical of the NCTM's assumptions is the fifth assumption, which states that during their schooling, students should grow in their ability to evaluate their own progress and performance. Students are given more of the responsibility of evaluating their own work as they enter high school.

Finally, the NCTM contends that a student's performance should be compared with specific performance standards, rather than with the performance of other students.

**Standards for Assessment:**

The NCTM spends the majority of the second section illustrating the six standards of assessment. The first of these standards is that "assessment should reflect the mathematics that is most important for students to learn" (29). The term "important mathematics" is an important metaphor within the *Assessment Standards*. One of the repeated phrases in the *Assessment Standards* is the following: mathematics teachers need to "communicate to the public the need for every student to know and use *important mathematics* {emphasis in original}" (149). The NCTM does not define "important mathematics" in the text, but rather, suggests that the *C&E Standards* are all about important mathematics. The NCTM argues,

"during the past decade there has been a radical shift in what the mathematical sciences community considers appropriate mathematical goals for all students--a shift from the belief that the
achievement of 'shopkeeper arithmetic' is sufficient for most students to the belief that all students need to develop mathematical power" (13).

The problem with this statement is that it is simply asserted and never proven. The mathematical sciences community, in this case, is the group of researchers publishing in NCTM journals. The NCTM does not demonstrate that regular K-12 teachers, especially those who are not NCTM members, approve or accept those changes.

Another problem, as the NCTM admits, is that students do not necessarily have to use "important mathematics" in dealing with teachers' standards that call for it. As the NCTM notes, "Identifying important mathematics in the assessment activities one chooses or creates does not guarantee that important mathematics will be elicited from those activities" (31). The other dangerous perception that arises from that statement is that given a performance standard, the students can produce the correct "behaviors." This is contradictory with the NCTM's assumptions that students are social learners of mathematics. The narrator has contradicted a basic position of the NCTM.

Additionally, the C&E Standards calls for assessments which include opportunities for students to be evaluated with mathematics they have not studied (31). This statement, which receives little backing in the Assessment Standards, is not easy for the traditional teacher to accept. The conclusion is by no means obvious. Many teachers would not
test a student on mathematics the student had never seen; yet, the Assessment Standards encourages the students to see how well they can learn new mathematics with little prompting from the teacher. This is an important claim that was not supported by the text.

The second NCTM assessment standard is that "Assessment should enhance mathematics learning" (35). One of the important warrants for the NCTM's conclusion is that "assessment should be considered a routine part of ongoing classroom activity, not an interruption" (35). The NCTM proposes a shift from assessments based strictly on tests to assessments based on informal observation. One of the major complaints of the NCTM is that external assessments, such as the Iowa Test of Basic Skills, stop the normal flow of learning and instead force teachers to "teach to the test" (36).

The NCTM seeks to have assessment answer difficult questions: instead of "Which students have acquired concept x or skill y," the NCTM wants to answer "Where are these students in the process of making sense of mathematics?" (37). The latter question is more difficult to answer, and requires a different set of skills. Further, the process can take much longer, as the NCTM points out that "immediate assessment can be quite misleading" (37). As scholars of rhetoric, we must investigate whether the NCTM provides teachers with the capability to answer that question.
The NCTM's initial answer to that question is that students must have the time and experience to integrate new ideas into their background (37). One aspect that is never answered, however, is how a teacher knows whether students have the necessary experience in order for students to start making their own judgments about their work. This is important because the NCTM defines learning as an active social process in which students construct their mathematical knowledge from experience (37). Further, the NCTM argues that "The process is individual--no two students 'learn' exactly the same thing from the same activity" (37). It then becomes difficult, if not impossible, to establish standards or rubrics by which the teacher can determine if students have the necessary experience.

The third assessment standard is equity. The NCTM highlights this standard, calling it "one of the highest and noblest priorities in our schools and in our society. There can be no compromise in our effort to assure that our mathematics assessments meet this standard" (39). The Assessment Standards also state, "Our assessments must be particularly vigilant about the standard of equity" (13). The problem the NCTM poses is that "Assessments have traditionally excluded differences, and consequently, their results have authoritatively excluded some students from opportunities to learn important mathematics" (43).
The purpose of this particular standard is to ensure that "Each student must be supported through assessment and learning in meeting high standards" (13). The NCTM recognizes the potential problems with this standard, commenting that "Even as professionals disagree on descriptions and means of achieving equity, its place as a standard is not in doubt and must not be compromised or devalued" (39). Thus, while it is important, the NCTM admits it is not quite sure what to make of equity.

The whole point of the standard is that each student is required to have background in "higher-order thinking, important mathematics" (39). In the NCTM's view, "Assessment must be designed to allow mathematical performance from students with limited understanding of the concepts, as well as for students who can display sophisticated mathematical thinking" (40). Every student should be given the opportunity to succeed in the NCTM's view.

Assessment standards are supposed to take students' background and differences into account. The NCTM argues, "If a student's response is interpreted at face value only, without considering other circumstances in the student's life, wrong or ill-informed decisions can be made" (41). All learning becomes situation-dependent. The NCTM uses the following argument to illustrate their point: "If a student is from a language community in which little value is placed on the display of information for its own sake, questions
that place a heavy reliance on such a display may work to the disadvantage of that student" (41). The backing for the NCTM's point makes little sense, because it is vague and does not provide any reasoning as to why the display of information could be important to the student. The NCTM must make the argument, though, because assessment relies on more conceptually oriented problems.

One of the facets of the equity standard is that students should be allowed to respond in their native language (89). They note, "Assessors should use English-enhancing and bilingual techniques to support students in developing their use of the English language" (40). This point is one of great contention for traditional teachers, and by itself, could cause many teachers to reject the equity standard. Teachers are particularly responsible for this standard; "All teachers need opportunities to become informed about the norms and values of different racial, ethnic, cultural, gender and social groups if they are to respond to their students' needs" (42).

The fourth of the NCTM's assessment standards is openness. Teachers in the NCTM's plan are supposed to include a variety of people in the assessment process, including parents, students, and other people (45). As a part of this process, students are given some of the responsibility for creating their own performance standards (46). Parents are also seen as important; without them, the
NCTM believes that the *Curriculum Standards* will not be implemented (47).

The fifth assessment standard deals with valid inferences, even though the NCTM sees validity as an outcome of the assessment standards and not a standard in itself. As the NCTM notes, "To be valid, an inference must be based on evidence that is adequate and relevant. The inference must also be based on the informed judgment of the mathematics assessor interpreting and using the evidence" (49). The problem is that the adequacy and relevance criteria are hard to define. The NCTM relates adequacy and relevance to the ability of the evidence to tap important mathematics, and how well it enhances mathematics learning by promoting equity. The problems here are great: the NCTM is defining a key idea in terms of other undefined concepts. Because there is such great disagreement on important mathematics, even within the C&E Standards, it is impossible to know whether or not valid inferences have been drawn. Furthermore, the NCTM journals have promoted portfolios as the primary example of obtaining additional evidence. As the *Assessment Standards* notes, portfolios create new biases (51).

**Purposes for Using the Assessment Standards:**

The NCTM then shifts the focus from the assessment standards to the purposes for which evidence about student performance is gathered. In this section we see the greater
use of vignettes in order to support the NCTM's hypotheses about assessment. The first vignette is especially significant; it "is related to all four bullets under the K-4 Measurement Standard," marking it as important mathematics (66). This is one of the few hints as to what "important mathematics" involves.

The vignette shows a primary teacher of unknown grade, preparing for her next day's lesson. The fact that her grade is not listed is significant; teachers from grades K-4 are supposed to feel as if they could accomplish the lesson. The lesson itself involved measurement of various objects, and features free indirect discourse. As Espinola notes, free indirect discourse occurs when the narrator speaks in the character's name, and the narrator is conscious of imitating a character's style of expression. For example, direct discourse might be phrased, "He thought, 'How calm the ocean is!'" while free indirect discourse would be to say, "How calm the ocean was!" The lesson in the Standards uses free indirect discourse in order to highlight passages and create the effect of reflection (Espinola 291). We are given the illusion that the narrators are reflecting on their situations, instead of the NCTM reflecting on those situations for us.

The purpose goes on to argue that "teachers should focus on the sense their students are making of important mathematics" (72). The problem is that sense-making is a
process, not an outcome. Mathematics teachers are not as well trained to evaluate process, and thus, are not familiar with many techniques for evaluating process, and thus, identifying a student's ability to "make sense" of mathematics.

**Implementation of the Assessment Standards:**

In the case of the Assessment Standards, the NCTM sees the implementation phase as crucial, and is as important as the actual assessment standards. The NCTM suggests that performance standards be adopted by local districts, with appropriate performance benchmarks.

The NCTM notes that the first step is to identify "big ideas" in mathematics. This is not a straightforward step. Although the Assessment Standards reference the C&E Standards, the only way the NCTM suggests creating "big ideas" is to look at the "bullets" in the content standards of the C&E Standards. From this step, then, the expected knowledge of the student is expected to be clarified.

After the teacher has an idea as to what the student should know, a variety of examples should be developed to assess the student's knowledge. This is significant to the NCTM as they cite a study demonstrating that students in predominantly minority classrooms rely on more standardized tests (16). The NCTM recommendations are similar to foreign
examinations, where a small number of problems are given that take longer to complete (17).

The fourth NCTM step toward adoption of the *Assessment Standards* is that new scoring procedures should be developed. The results of student performances are supposed to be reported to students, parents, teachers, administrators, and policy makers (18). These reports are not to be collapsed into a single score, but rather, are to retain all the information gathered in an equitable way. The NCTM uses the term "scoring rubric" as a key term. Scoring rubrics are simply guidelines by which students should be evaluated.

The NCTM then desires that results of student performance be sent to students, parents, teachers, administrators, and policy makers. The form of the reports would vary based on the audience, but all such reports should "preserve the richness of the information" (18). Finally, the reporting system must take equity into account.

The Revolution Begins: Examining the Opening Vignette:

The NCTM places great importance on the opening story both in the *Professional Standards* and in the *Assessment Standards*. The NCTM uses these stories to illuminate the revolutionary nature of assessment in the classroom. In the introduction to the vignette, the NCTM suggests that in the traditional classroom, assessment is limited to spot checks on homework, as well as a weekly quiz and chapter test. As
the NCTM argues, the reform vision is quite different. The classroom featured in the vignette "is in harmony with the Teaching Standards" (19).

The vignette is a hybrid of a letter and classroom dialogue. It starts as a letter between Shelly and Jan, two teachers who met during a summer workshop. Shelly makes the observation that statistics takes on narrative qualities: "working with statistics is like reading and telling stories" (20). Later in the vignette, she asks her student, "what's the story here?" (23) The student responds by saying, "Exactly the right question! The class needs to tell a story, a statistical story" (23). While this exchange may seem fairly normal in a communication setting, it is a radical stance to take in the mathematics education community. The notion that statistics is a mathematical story is something that most traditional teachers do not accept at face value. This position is not predicated in the narrative, but rather asserted as true, which makes it harder for the traditional teacher to accept.

As far as relating the vignette to assessment, the fourth paragraph of the first letter illustrates the links between lessons and assessment. Shelly claims that a combination of group reports, individual writing and a problem of the week will be sufficient to track the progress of her students.
The vignette then takes a departure from the letter form and begins a conversation between three teachers. This is where the NCTM tries to personalize the narrative form. In a radical departure from the Professional Standards, the Assessment Standards gives us details about the characters: 

"[Shelly] maneuvered her short but sizeable body back through the maze of tables" (20). Additionally, the discourse is no longer free indirect, as it was in the previous two volumes of the Standards. Characters in the narrative are allowed first-person dialogue. This is one of the major shifts in the Professional Standards.5

After the brief dialogue, Shelly writes another letter to Jan. This second letter focuses on emotional responses to the unit Shelly taught in statistics. She notes, "I was also anxious, especially about assessment" (22). The NCTM uses this piece of dialogue to begin the response to critics who attack assessment. Instead of using analytic text, the NCTM makes the choice of using narrative forms.

Shelly highlighted two responses that traditional teachers might make with regard to updated assessment techniques. First, traditional teachers might argue that students will not know how they are being evaluated. Shelly recognizes the potential weakness: "even though the standards were on the wall, I still wasn't sure that students understood how I was evaluating them" (22). This would be a major problem--students understand how they are evaluated on
tests, but not necessarily in new assessment forms. Shelly simply acknowledges the criticisms, but does not make a direct response to the criticisms, allowing the text after the vignette to perform the function of response.

The vignette is followed by the NCTM's evaluation of what happened. The narrator of the first section argues that Shelly's lesson was completely successful in meeting one of the NCTM's six assessment standards, while she still had to work on five of the standards. The NCTM labels the process as a "struggle most teachers are experiencing as they try new approaches to the teaching of mathematics to fit the reform vision" (24-25). The NCTM does commend Shelly for tapping the experiences of her students.

The key question the NCTM fails to answer in this section is why a traditional teacher would want to make that effort. The only response that deals tangentially with this question is the NCTM's observation that "We apply at our peril traditional methods and narrow evaluations that ignore the gift of diversity to which our continent is heir" (25). Somehow the NCTM must respond to the belief of traditional teachers that mathematics is culture-free instead of being culture-bound. While it is laudable for the NCTM to recognize diversity in the mathematics classroom, they fail to provide good reasons for why the alternative is poor.
Attacks on the Instrumental Teacher:

The Assessment Standards clearly fail to be innovational, for the text personalizes the attacks on instrumental (or traditional) teachers. The vignettes also reinforce the attacks, sometimes even mentioning characters by name: “No doubt about it. Adele would sabotage any proposal for change” (137).

At other points in the text, the vignettes drip with sarcasm. Dolores, one of the 10th grade teachers, tuned out her principal by referring to his remarks as "blah...blah...blah" (100). Her attacks on standardized testing continue, as a fellow teacher comments, "You should be happy the General isn't down our throats this year about the scores" (100). Dolores even told her students "that she wanted their help in determining how accurate the test was" (101). Another teacher simplified her colleagues' approach to teaching by saying: "You mean you only look at test scores? And you just pass everyone, no matter what?" (164).

The attacks also continue in the purpose of evaluating programs. Terry Taylor, the traditional teacher, tells his colleagues, "Give me a kid that's ready and I can teach 'em" (184). His sarcasm toward the new models is evident, as he attacks portfolios: "Innovative High does some weird things...they make the students turn in a folder of work before they grant diplomas [ellipses in original]" (184). Terry's position is dismantled by the other teachers. His
department chair noted, "Students at Innovative are required to do a lot more to demonstrate achievement than just pass tests--that doesn't sound weird to me" (184).

What is clear in the Assessment Standards is that the criticisms come more personally, and are the result of teachers attacking other teachers, something not found in the C&E Standards or the Professional Standards. Given that alternative assessment is a relatively recent area of educational research, the NCTM apparently felt the need to personalize the attacks. Burke notes that the scapegoating serves an important rhetorical function: it "represents the iniquities of those who would be cured by attacking it" (Grammar 406). In other words, the NCTM must cleanse the educational curriculum of reformers' past mistaken practices.

The Portfolio as Paradigm Case:

Instead of just criticizing traditional teachers, the NCTM must ultimately present a better vision of education in order to encourage traditional teachers to adopt the Standards. One of the problems the NCTM must confront in the Assessment Standards is that people are not sure how to conduct alternative assessment methods. Accordingly, the NCTM must offer some examples. The major case the NCTM uses is the portfolio. Students turn in either all their work, or selected samples of their work, in a portfolio, much as students have done in art and English classes. Portfolios
have been "discovered—and enthusiastically embraced—only recently by the mathematics education community" (134). In fact, portfolios are the major tool that has been covered in alternative assessment in journals such as the *Mathematics Teacher.* One author argued that portfolios "are instrumental in working with students to meet high expectations and perform to the NCTM's *Standards*" (Asturias 701).

The NCTM never clearly identifies the problems with portfolios, but recent articles demonstrate some of the difficulties teachers face. As Kuhs argues, portfolios may potentially violate the NCTM standards of validity and equity: "A teacher's system of using and evaluating students' portfolios will be no less fair, reliable, and valid than another teacher's system of designing and grading tests, projects, and assignments" (335). The NCTM is advocating the use of an item that ultimately leads to the same problems it highlights in the *Assessment Standards*: the resulting information will be no more or no less valid than any other information. Additionally, the problem of how to evaluate student responses such as this Vermont student's response remains: "Although I didn't clearly explain the reasons for my decisions, my work suggests reasoning was being used" (77). The student believed she or he used reasoning, and followed the dictates of the form. The
example suggests that without proper care, other forms of assessment will follow criteria too closely.

The Rhetoric of Reiteration:

As we mentioned in chapter four, the Standards are self-referential. The Assessment Standards are the best example of the Standards volumes what I would term the rhetoric of reiteration. We see reiteration coming in two forms: self-referencing and repetition.

The Assessment Standards are even more self-referential than the Professional Standards. We find examples of references to other volumes of the Standards in the vignettes: "This experience also caused the teacher to question the importance of the division of fractions in his curriculum and confirmed the wisdom of the NCTM in deemphasizing fraction computation out of context in the C&E Standards" (107). A later vignette notes, "She was interested in finding a way to incorporate new assessment methods, such as portfolios and journals, and the ideas presented in the NCTM Assessment Standards into her grades" (130). The vignette also refers to the 1993 NCTM yearbook on assessment.

What was not present in the Professional Standards, though, was any kind of indication that the Standards were successful at levels larger than the classroom. The Assessment Standards make some of these kind of arguments:
"Remember, their department chair told us how they are trying to implement the NCTM Standards. And now he says their enrollment in the top classes is increasing" (184).

The Assessment Standards also use the device of repetition. We see the same themes coming up continually, such as the attacks on tradition, the need for diversity and equity, and the importance of following all three volumes of the Standards. The need for diversity is highlighted in the NCTM's belief that "We apply at our peril traditional methods and narrow evaluations that ignore the gift of diversity to which our continent is heir" (italics mine; 25).

Instead of a linear, logical form, the Assessment Standards continually refer back to previous sections. In the purpose of validating student achievement, there are three references to vignettes previously covered in the chapter, while purpose seven, "Addressing Accountability Issues," is a restatement of the first six purposes (192-195). The NCTM uses the device of amplification. Amplification serves to enumerate the parts of a particular subject, rather than extending the central idea (Anderson 42-45).

**Feminist Problems With the Assessment Standards:**

The NCTM seeks equity and diversity as important goals of the Assessment Standards. One of the problems the NCTM has with these goals is that they treat women in the dialogue
as the weaker sex. Two vignettes illustrate the problems the NCTM has in this area.

In the introduction to one dialogue, we read the following passage: "Late one afternoon, Ms. Dobbs stopped in the teachers' lounge for a cup of coffee, where she encountered two fellow teachers, Mr. Roth and Miss Frank. "Wow, you look trashed! said Mr. Roth" (164). The fact that the NCTM uses this illustration is damaging to their credibility on equity and diversity: women are somehow the weaker gender, especially in mathematics. The vignette offers a simplistic solution: "I can help," said Mr. Forthright..."What you need to do is use the new standards" (165). The Assessment Standards would not do anything for Ms. Dobbs' health, and given the increased demands the Standards place on each teacher, might actually make her worse. While the Professional Standards and the C&E Standards seek to place women in positions of respect and authority, the Assessment Standards actually undermine that authority. Another anecdote just a few pages later continues: "I can't ever remember ever being this tired...I don't even have the energy to lift my hand. It must be adrenalin loss." "As she drove, she reflected on the three-day meeting that just ended. "I feel like a mother hen with chicks" (175). Again, the problem is that men are never shown to be weak or tired, but always women. While a feminist critique is not called
for of the entire text, this analysis does demonstrate the deeper credibility problem the NCTM faces.

Progress Toward Reform:

One of the problems with the Assessment Standards is that the transition from traditional practice to reformed practice is ambiguous: "the transition from current practices to a realization of this vision will not be easy, nor is the path clear" (8). Additionally, the NCTM warns teachers that "There are more surprises and frustrations because the job of teaching has changed" (25). Indeed, "enactment of the vision NCTM has presented in its three Standards documents will look and feel different in different sites" (25).

The ambiguity present in changed practices can be unnerving to traditional or other teachers. At one point, the NCTM states in a vignette, "I am not saying this scheme is the best one, only that I like it for my class. You can use a different scheme" (133). The problem, of course, is that there must be some degree of coherence, if only to the Standards.

While the steps toward reform are ambiguous, the goal is not. In the sixth purpose, the text argues, "the primary purpose of a mathematics program evaluation is to obtain information that will lead to judgment of a program's effectiveness in terms of the achievement of program goals
and their alignment with the C&E Standards (174). While the NCTM urges schools to adopt the Standards as they make sense to a particular system, there is still the overriding concern that all of the Standards be adopted.

**Conclusion:**

The purpose of the Assessment Standards is to make the Standards a unified whole, adopted throughout the United States and Canada. As the NCTM notes, "the assessment systems currently used by most states, provinces, districts, and schools are not consistent with the goals of the reform efforts in mathematics" (12). This is where the NCTM faces its biggest paradox; while they want states to be responsible for their own curricular decisions, the NCTM's goal remains to have the Standards adopted nationwide. As NCTM President Jack Price notes, "we sincerely hope all schools will have taken a few steps [of reform]" and that "the federal and state and provincial governments support the direction in which mathematics education reform is heading" (3).

The problem, as the NCTM acknowledges, is that "Parents, administrators, school boards, and policy makers are faced with the challenge of understanding the changes in the teaching and learning of mathematics and the consequences of those changes for students" (13). The Assessment Standards, while a start in that direction, do not ultimately succeed in
guiding teachers and administrators in implementing changes in grading and assessment procedures.

Notes:

1. The Assessment Standards are currently in working draft form. According to the NCTM, they were released at a press conference on May 23, 1995, but have not yet been sent to all NCTM members. The term "compliment" is the one the NCTM uses (see p. 1, Assessment Standards).

2. See the Fulkerson piece on Martin Luther King Jr.'s letters from prison.

3. Indeed, this standard is important enough to be the topic for the NCTM's 1997 yearbook.

4. See Asturias and Kuhs, op. cit.

5. What remains to be seen is whether or not these changes will make it into the final draft of the Professional Standards.

6. While an entire issue of the Mathematics Teacher (November 1992) was devoted to alternative assessment, none of the topics mentioned in that issue have been discussed in Mathematics Teacher since.
CHAPTER 6
CONCLUSION

Introduction:

The NCTM Standards were intended as a visionary set of documents as well as a way of life. As NCTM President Mary Lindquist explained, "NCTM members are the pioneers who must take the vision of the Standards and pass it along to students in the classroom, fellow colleagues, parents, community leaders, and policy and decision makers" (469). Skip (Francis) Fennell, a member of the NCTM board of directors, highlighted the Standards this way: "we want to make sure that people realize that we (the Council, the Standards, whatever) are about appropriate (good) mathematics for all students" ("Boston" n.p.)

The NCTM views the Standards as "definitive documents about what we value in mathematics education" (Frye 312). It is "the benchmark of a challenging, but achieveable, mathematics program for all students" (Frye 312). The Standards should "fundamentally change the teaching and learning experience" ("Recharge" 10).

The question we must ask after analyzing the three volumes of the NCTM Standards is whether the vision of former NCTM presidents Frye and Lindquist has come to fruition; are people using the Standards? Are the Standards "already reshaping mathematics education today and for the twenty-first century?" (Reshaping 10).
In order to answer these questions, we must consider what it means for the Standards to be "successful." Clearly, the NCTM would have a difficult time convincing 100% of mathematics teachers to adopt the Standards. Some teachers are minimally qualified to teach mathematics, and will not have the ability or the training to engage the Standards. These teachers would require far more training in order to fulfill the mandates of the Standards. We can start by assessing the data that measures how well the Standards are being used. We must continue, though, by investigating how well the Standards are engaging traditional teachers; in other words, are teachers willing to consider their pedagogical styles and modify those styles in response to the call of the Standards? We will then use these findings to explore the effectiveness of the rhetoric of mathematics. Finally, I will highlight several conclusions derived from this study.

Data in Support of the Standards:

At this point, we have very little data collected as to whether or not the Standards are being adopted. One study published by the NCTM was based on 550 schools in four states.1 The study implied that "practice in high school mathematics is beginning to shift in directions consistent with the NCTM's Curriculum and Evaluation Standards" (Garet and Mills 385-386). A closer examination of the data
indicates that on a 1-5 scale, where 1 indicates few practices in line with the Standards, the schools in the survey had averaged a 2.1, which is an improvement from an average of 1.5 in 1986 (384).

Assuming their data and hypotheses are valid, schools will not be in line with the Standards until 2006, nearly 20 years after their release, and well after the Standards are due to be revised. Garet and Mills also point out that the use of the Standards in rural communities lags greatly as compared to suburban communities. This suggests that the Standards are being adopted incrementally, and perhaps not as quickly as the framers of the Standards desire.

The other study published about the impact of the Standards examines whether teachers in Kansas were aware of the Standards. In this study, Parker and Kurtz found that only 17.6% of teachers were aware of the Standards (622).

Parker and Kurtz also found that K-4 teachers in their sample were generally satisfied with their pedagogical practices, ranking their teaching between a 3.69 and a 4.04 on a 1-5 scale (625). These findings include the belief that the current methods for assessing students are adequate.

This leads to two important questions about the Standards: why are they seemingly not being accepted in rural or in inner-city schools, and what can the NCTM do about the problem? As this study on the Standards suggests, urban schools will be the first to implement much of the
Standards. A further examination of the Garet and Mills study indicates that urban schools may be an all-or-nothing proposition, as a significant number of urban schools plan no adaptation to the Standards (384).

One suggestion is that teachers in rural schools are less likely to have heard of pedagogical reforms, and thus, are more likely to teach in traditional ways. While the Parker and Kurtz study fails to tell us where their sample originated, the fact that Kansas is more of a rural state suggests that there may be significant barriers to change.

One of the major factors the NCTM must counter is complacency. As Parker and Kurtz suggest, many teachers are satisfied with their classrooms and their teaching of mathematics. The Standards, on the other hand, implicitly assume that teachers are continually dissatisfied with their performance, and would always like to improve.

The net impact of this is that teachers who have been in the classroom for several years do not always see the need for change. Further, when these teachers are confronted with change, they do not always accept change, and indeed, revert to old ways of teaching. One of the problems cited with the NCTM Standards is a regression tendency, where preservice and inservice teachers encounter the Standards, but end up reverting to traditional teaching (Flores 428). This was a function of the length of time teachers were in the classroom: "the more time student teachers spent in schools,
the less they tried these ideas and the more they taught by the book" (Flores 428). Indeed, given the NCTM's membership base, this makes sense. Most of the NCTM's readership has been in the profession for more than 15 years, while only 23% of the NCTM's membership is below the age of 39 (Lindquist 469). Younger, inexperienced teachers are ironically less likely to be in the NCTM and less aware of the history and importance of the Standards. This suggests that the NCTM must somehow find ways of encouraging teachers to not only stay in the profession, but also, to surround new teachers with teachers experienced in the Standards. The former suggestion is certainly beyond the realm of the Standards, while the latter suggests a focus of inservice and preservice education. The NCTM could challenge teachers, both within the Standards and in supplementary texts, to find ways of making the Standards meaningful to the teacher's individual classroom.

Data Concerning Technology and the Standards:

The C&E Standards strongly promote the use of technology in the classroom, calling the use of technology one of the most important aspects of the volume. Yet, there is little evidence that technology is used to full advantage in the American schoolroom. In fact, teachers report that 47 percent of 4th-graders and 22 percent of 8th-graders were never asked to use a calculator in mathematics class. This
was a finding of the 1990 NAEP assessment in mathematics (Elliott). NAEP results show that NCTM's recommendations have not been implemented. According to their teachers, only 3 percent of 4th-graders and 19 percent of 8th-graders were permitted free and open use of calculators; only 2 percent of 4th-graders and 34 percent of 8th-graders were permitted to use calculators when taking tests. And, as indicated earlier, teachers reported that 47 percent of 4th-graders and 22 percent of 8th-graders were never asked to use a calculator in mathematics class. Fourth-grade teachers tended to use calculators somewhat more frequently in their high-ability classes; 8th-grade teachers said they used them least frequently with their low-ability classes. Although there are some exceptions, more-proficient students appear to have more opportunities to use calculators than their less-proficient peers (Elliott).

In many cases, technology is not widely available, accessible, or used to advance students' mathematical thinking. The Parker and Kurtz study noted that few K-4 teachers saw the need to use calculators or computers, ranking them as their lowest priority (623).

**Why Have People Not Yet Accepted the NCTM's Argument?**

Given the data that suggest that the Standards are not being fully utilized, we now need to understand why. Educational researchers have proposed two theories, which I
will further expand by looking at two ideological concerns of the Standards.

One of the reasons educational researchers cite for not using the Standards is the problems with the Standards and standardized testing. In the current educational climate, many teachers are required to demonstrate that their students perform well on standardized tests. Many of the standardized tests are partially or completely incompatible with the Standards (Flores). As Silver and Kearney point out, only about half of the items on the NAEP exam were related to the C&E Standards (164).

Further, teachers are afraid to vary their instruction because of the tests. Petersen describes the process:

> When a district reviews the Standards and decides to emphasize other concepts to build number sense in children and delay introduction of concepts such as number sense in children and fractions until more children are developmentally ready to understand them, ITBS scores go down, parents see red, and teachers begin to supplement the designed curriculum with the old curriculum...to reduce the pressure being applied by irate parents (Petersen 1).

As a result of parental involvement, teachers find themselves beginning to use the Standards, and then turning away from the Standards because of parental concerns.

The NCTM attempts to respond to this problem in the Assessment Standards. One of the vignettes is a parent-teacher conference, where a teacher tries to demonstrate to a mother what happens in a Standards classroom. The problem with the vignette is that it never addresses the issue of
external standards. Rather, it is a theoretical look at why performance standards are desirable, and does not address the concerns of parents. Instead, we are forced to look at a different vignette in the summative evaluations section to find some of these concerns addressed. The parents in the vignette ask the teacher a series of three questions that deal with the Standards controversy. At first, the father asks, "When are you going to learn about using formulas and working with numbers?" (Assessment 119). The father later asks, "When are you going to learn serious (or real) math?" Finally, the mother wonders whether his daughter Marisol is "just being used as a guinea pig for a 'new math' that is sure to be given up sooner or later?" (120). The father, though, remains unconvinced at the end: "I'm still not sure that Marisol is learning all she needs to learn" (121).

What is interesting for us as rhetorical scholars is the way in which the teacher, Mr. Flater, responds to the criticisms of Marisol's parents. Mr. Flater answers the question of whether Marisol is a guinea pig by responding, "Our faculty is working together in deciding what and how to teach and how to preserve the continuity of our program. The documents on content, teaching, and assessment from the NCTM are the basis for our discussions. But we certainly have a long way to go" (120). In addition to the self-referential nature of the text, which we have seen throughout the Standards, we see the NCTM providing an inadequate response
to Marisol's mother, and ultimately, to those attacking the Standards for being just another "new math" reform. Indeed, the teacher only responds to the question about formulas by saying, "We will learn the formulas when we need them through the activities we do in the unit" (119). The father was unconvinced.

This vignette offers the NCTM the opportunity they are seeking, a chance to respond to criticisms that the Standards are just another example of new math. Yet the NCTM fails to do so. I would argue that this response represents a serious rhetorical mistake: not responding to one's opponent. As a result, parents are left wondering how well their sons and daughters will do on standardized tests.

So instead of attacking the beliefs parents have, the NCTM chooses to attack the standardized test itself. The NCTM argues, "The sooner the [traditional test's] use is discontinued and replaced with alternatives, the sooner mathematics reform efforts will succeed" (Assessment 225). Indeed, a strand of the Assessment Standards even encourages teachers to stop giving grades: "Why can't we just write a descriptive paragraph about the students' strengths, weaknesses, and progress?" (130).

The other reason educators believe the Standards is not being adopted is because of student apathy. In Flores' view, "Teachers must work with students for whom mathematics has no meaning, and who do not want to see a meaning, [and] who
expect learning to be boring" (429). The Standards do not focus on student apathy, nor is it necessarily the Standards' prime concern. This is a variable that future revisions of the Standards must take into account.

Given that the Standards have not been fully implemented, we must return to the question posed earlier in this chapter: are the Standards engaging instrumental teachers and forcing them to at least consider alternative viewpoints? One of the problems the Standards faces is that there are great philosophical differences between traditional teachers and reformers. The Standards are based on completely different set of philosophical assumptions. One teacher forces us to remember that "the Standards are not traditional. They embody a constructivist learning theory that is contrary to many teacher's [sic] belief systems" (McElwain). Many of the authors supporting the Standards are constructivists at heart. Koss and Marks recognize reform efforts are "grounded in a constructivist view of learning" (616). One of the aspects of constructivism is that "mathematics is seen as a socially constructed body of knowledge" (Assessment Standards 12). While a rhetorician sees little trouble with this statement, it is of great concern to the mathematician.

The Standards also have a more basic question that critics pose. Ballew echoes the concerns of many when he argues: "I believe that most math teachers [sic] involvement
with the mathematics reform was primarily driven by a perceived lack of student acquired knowledge and understanding. The goals and motivation were predominantly to answer the eternal question, why can't Johnny (Joanie) count?" ("Standards War") The problem, as Ballew indicates, is that the Standards are ideological. He continues, "My perception, founded or unfounded, is that there is a PC tone to the NCTM now. Despite lip service to teacher experimentation and independence, the tone is 'We are right and they are wrong', and this moves us away from teacher empowerment and independence" ("Standards War").

From this analysis, I believe that we can draw several important critical lessons. The first lesson concerns the NCTM's paradox between being innovational and transformational, as we have seen in previous chapters. I would argue that the NCTM should have adopted an innovational approach. Innovational approaches do not completely destroy the past, but rather, use the past as a starting point by which future changes can be made. As Coste's analysis of narrative confirmed, narratives rely on the past in order to reorient the future. The NCTM created too great of a break with the past, which resulted in cognitive dissonance. Changes in pedagogical theories do not take place quickly. While many mathematics educators were aware of new theories of instruction, many teachers were not. By introducing the philosophical shifts incrementally, the NCTM could have
better served its purposes. In order to empower teachers, change must come in ways that teachers can understand and utilize readily. The time lag between the *Curriculum and Evaluation Standards* and the *Addenda* series was a problem for the NCTM. While the *Addenda* helped teachers to better understand and apply the *Standards* to their classrooms, the *Addenda* was not immediately available. Thus, for a period of time after the publication of the *C&E Standards*, some teachers were not able to implement the *Standards* in their classrooms.

Smith and Windes note that innovational movements can teach us about institutions in general. They argue that as the hope of radical change fades in a post-industrial America, innovational movements will become increasingly important in public discourse (152). We can see this within educational movements such as the history standards, as well as the NCTM *Standards*. In an era that distrusts radical changes, innovational movements can provide us with insight as to how a group can accomplish its goals through the use of rhetoric. In the case of the NCTM, the *Standards* could have shifted some of the philosophical changes from the first volume to the second volume, as well as by using examples that demonstrate to the reader that the changes required are not drastic.

This analysis also suggests that we pay closer attention to rhetorics of reaffirmation. In addition, I believe that
there may be more to Lessl's idea of expert discourse than has been previously discussed. Finally, we can begin exploring the rhetoric of mathematics. I will discuss each of these ideas in turn.

The Role of Reaffirmation Texts:

The Standards have not succeeded on the level of encouraging traditional teachers to change their practices, and whether the Standards will do so remains to be seen. The success the Standards has enjoyed in the first six years is due to its role as a reaffirmation text. The NCTM believes that the three Standards documents are highly integrated and need to be considered as a whole. For example, the Assessment Standards emphasize their relationship to the C&E Standards, as I mentioned in chapter five. The NCTM notes that the Assessment Standards "have been designed to expand and complement, not replace, the Evaluation Standards" (Assessment Standards 11). One possible reason for the failure of the NCTM Standards is that the linkages are reaffirmations rather than arguments.

The NCTM certainly makes the attempt to link the various volumes of the Standards. As we have seen, many of the vignettes are self-referential, with the Assessment Standards referring consistently to the C&E Standards.

The Standards project, as we have seen, has been a rallying cry for the NCTM. Lindquist remarks, "Those who
oppose change expressed their opinions, which only strengthened our resolve" (468). Reaffirmation texts do not necessarily rely on proven assumptions to make their case. Indeed, the NCTM does not feel the need to prove its assertions through evidence. The Research Advisory Committee wrote, "The Standards document contains many recommendations, but in general it does not provide a research context for the recommendations, even when such a context is available" (115). The response of the NCTM to the critics who attack the Standards for lacking a research base is that there is no available base of relevant research. As Anderson shows, "simple insistence can be seen as persuasive, a means of heightening our awareness of propositions and thus of securing our adherence to them" (37). To those who believe that research will confirm the Standards, the lack of a research base is not critical.

Instead of having a research base for the Standards, the NCTM instead advocates a series of qualities found in each of the volumes. Beginning with the first volume, the Curriculum and Evaluation Standards, the first quality mentioned is "mathematical power." The NCTM believes that all students should have mathematical power. The Curriculum and Evaluation Standards define mathematical power, the Professional Standards illustrate how to guide students to obtain mathematical power, and the Assessment Standards show how to identify how much mathematical power students possess.
The *Standards* thus use repetition as well as qualitative progression, which simply states that "the presence of one quality prepares us for the introduction of another" (Burke *Counter-Statement* 125). In other words, we look not for a strict logical form, but rather, a progression in the qualities discussed until we reach an ultimate quality. The *Assessment Standards*, then, are the culmination of the principle of mathematical power. The quality is discussed repeatedly in order to show how teachers and students working together can create mathematical power.

Burke also explains the repetition form, showing that "By a varying number of details, the reader is led to feel more or less consciously the principle underlying them--he then requires that this principle be observed in the giving of further details" (*Counter-Statement* 125). This is where, in my judgment, the NCTM *Standards* initially fail. Teachers wanted more details about how to adopt the *Standards* in their classrooms, and how to personalize the narrative. Until the NCTM came out with the addenda, teachers did not have a series of problem situations to model in their classrooms.

The reaffirmation text must perform three functions. First, the reaffirmation text is that it must somehow strengthen the resolve of those who are aligned. This can be done in a variety of ways. The most prevalent method in the *Standards* is through repetition. Anderson argues, "what is repeated often enough and strongly enough cannot be ignored"
The NCTM hopes that by continually preaching the Standards, instrumental teachers, parents, lawmakers, and business leaders will be forced to consider the NCTM's claims and side with the NCTM's view.

The second task of a reaffirmation text is to create a scapegoat that is easily torn down. In both chapter three and chapter five, we explored the instrumental teacher as a scapegoat. Burke suggests the scapegoat shares iniquities with the attackers (Grammar 406). Indeed, an article based on the Professional Standards suggests that the teachers must rethink how "we" teach (Prevost 75). In this case, "traditional teaching" is the scapegoat, and the simple solution is to adopt a mindset that encompasses constructivism and a willingness to change.

At the same time, however, the reaffirmation text must demonstrate that the reader can easily perform the needed action. One article about the Assessment Standards notes that teachers should spend "not more time but more quality time [emphasis in original]" (Clarke and Wilson 545). When phrased in this manner, teachers are asked to believe that they can actually engage in the needed reforms. The Professional Standards use the technique of having teachers collaborate on solutions in order to emphasize the same purpose. For example, teachers observed each other in order to see how much class time was spent on reviewing homework.
The tasks involved are not demanding, yet provide tangible results and guidance.

The reader will feel more likely to act if the text sustains the belief that change is possible. This is where the NCTM Standards function as a reaffirmation text, and where the NCTM Standards have problems. Many teachers identify specific vignettes or specific strategies that they can accomplish. However, the entire text undoubtedly looks daunting to many teachers, who probably feel they cannot accomplish all of the goals of the Standards.

The nature of the text, though, prevents the NCTM from simply identifying a series of steps teachers can take to uphold the Standards. Implementation of the Standards of the Standards varies from place to place, and thus, while the NCTM tries to set forth absolute values of education, the only absolute is that the Standards are written from a constructivist viewpoint.

Extensions of Expert Rhetoric:

This study also used Thomas Lessl's notion of expert discourse to examine the role the NCTM played in the mathematics education community. The study moves beyond the level of identifying the role of such rhetoric, suggesting there are more qualities to the expert persona that need to be examined. As Burke noted, we have previously used "theological principles [that] can be shown to have useful
secular analogues that throw light upon the nature of language" (Rhetoric of Religion 5). The qualities that need to be explored in elite discourse include the evangelical nature of this rhetoric, as well as the need for conversion.

First, this study expands the concept of expert rhetoric to consider the nature of fundamentalism and missionary work in the sciences. Lyne and Howe believe that one of the reasons for the success of sociobiology is that it became transdisciplinary. In other words, sociobiology transcended disciplinary boundaries and became a part of multiple disciplines. The NCTM has attempted the same function in two unique ways.

The NCTM sought to have their reforms certified by a variety of outside disciplines, including English, history, and physical education. This allows the NCTM to move beyond the mathematics classroom into the fields of educational psychology and pedagogy. The NCTM sought to place the mathematics reform movements at the head of educational reform, and in this regard, they were successful. Reform movements in several K-12 subject areas all cite the NCTM Standards as being influential in their work.

The NCTM also seeks to be missionary within the fields of mathematics and mathematics education. It is the NCTM's hope that the Standards will permeate the college classroom as well as the K-12 classroom. In fact, work has already begun on standards for 12-14 classrooms, and the NCTM would
like to see standards for all undergraduate college classrooms. The NCTM clearly sees itself as the prophet for normative behavior: "This project has the potential to represent a new role for a professional organization...[the NCTM] also will have taken some responsibility for describing the schools' interpretation of these standards" (Ferrini-Mundy and Johnson 193).

Lessl notes the tension in expert rhetoric between trying to maintain elitism and to encourage new adherents. For the NCTM, this means the expert mathematician must humanize math and mathematize humanity. This tension manifests itself in efforts to draw out those aspects of the ordinary mind that already envision a mathematical character (Lessl 190).

The Standards certainly suggest drawing out mathematical character through connections to real-world activities. The Addenda series to the Standards provides many examples of real-world activities in which students can participate. One of the reasons for the Addenda series is that the Standards themselves did not provide enough practical examples that classroom teachers could use.

The NCTM Standards as Conversion Narrative:

The expert rhetor has a variety of strategies available to convince people to adopt the rhetor's worldview. The method that the NCTM uses is through example. The NCTM
Standards are a conversion narrative. Viewed in this light, the Standards are written by people who have seen great problems in their teaching and in the teaching of others have sought to create new standards to remedy those problems. Indeed, this is one reason why we see the emphasis in the NCTM's journal articles on practical experience. One of the few articles dealing with assessment in the classroom comes from a personal point of view: "I discovered that devising, or even using, Standards-aligned assessment tools wasn't as straightforward for me as the writers of the document must have intended it to seem" (Schloemer 722). We see in this narrative the element of "I once was lost, but now am found" prevalent in the conversion form. Further, as Arnie Madsen suggests, the representative anecdote is both act and form. This address is typical of evangelical rhetoric, which has both unifying and disengaging characteristics.

**Toward the Rhetoric of Mathematics:**

We have also learned that the rhetoric of mathematics is not simply deductive reasoning, but rather, a product of arguments made in public forums (Gross 58). We can further explore the rhetoric of mathematics by examining both its internal and external character.

The area that the NCTM Standards spends the greatest time in identifying is the internal rhetoric of mathematics. We know that many see the technical vocabulary of mathematics
as too difficult ("Language of Mathematics" 1). Also, one of the goals the NCTM Standards accomplishes is the demystification of numbers. Merriam suggests that numbers appeal to people because of their perceived precision as well as their apparent exactness and objectivity (338).

Indeed, some scholars suggest that there are five mathematical parts of speech students must learn: number symbols, operation symbols, relation symbols, grouping symbols, and placeholder symbols. Of these five symbol types, two have no counterpart in English ("Language of Mathematics" 2). At the linguistic level, this creates ambiguity and insecurity.

The internal rhetoric of mathematics contains a great deal of ambiguity, and is inherent in the mathematical form. We see the issue of ambiguity arise in mathematics textbooks. As Tobias notes, "Some mathematics texts solve the problem of ambiguity by virtually eliminating language" (54). The only problem, though, is that the texts based on the Standards still eliminate language, and thus, do not succeed. Interestingly, Tobias does not argue that ambiguities should disappear from mathematical rhetoric, but rather are inherent in the form. She contends, "Besides, even if mathematical language is unambiguous, there is no way into it except through our spoken language, in which words are loaded with content and associations" (51).
As an example of this experience, she talks about multiplication. In most contexts, "multiply" and "increase" are synonymous. Yet, when we multiply two fractions each less than 1, the result is less than the two numbers we had originally (e.g., $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$). The ambiguity is present because of what I would call mathematical irony, which occurs when students not only notice the ambiguities and paradoxes in mathematical language, they seek them out (Kutzko).

The problem with ambiguity is that it also moves to a deeper level, to the students in mathematics classes. Tobias argues that the language mathematicians use confuses the average person. In her words, "Mathematicians rely heavily upon customary notation. They have a prior association with almost every letter in the Roman and Greek alphabets, which they don't always tell us about" (51-52). Tobias' argument is there is a "code" describing mathematics which is inaccessible to many people; people are mystified by the notation rather than the argument. Even when mathematicians use familiar letters, the result may be the same. The language, therefore, appears to be an ever-widening crack in the bridge that prevents others from reaching the answer. Ambiguity in the language of mathematics is often cited as one problem. Tobias further states, "Mathematics autobiographies show that for the beginning students the language of mathematics is full of ambiguity" (48).
This perceived irony within mathematics can create great confusion for the student. The dangers of this are acknowledged by Wayne Booth when he states, "For the determined ironist any anomaly or incongruity is ironic, and almost any phenomenon can be seen as incongruous in some light or other: what is not incongruous viewed locally will be found so when placed in a larger context. It may be the workings of fate. . ." (Rhetoric of Irony 236). Students might immediately see what is ironic as contradictory, and unfortunately, claim that understanding mathematics is more often related to fate than cognitive ability.

External Rhetoric of Mathematics:

The examination of the Standards has led us to consider the impacts of a constructivist viewpoint for mathematics. As far as investigating mathematics, we must consider the role of the larger discourse community. Much as rhetoricians of science look to communities to validate claims, van Bendegem suggests that we look to the mathematical community as the community certifies whether proofs or explanations have met their standards (32). The question that rhetoricians must investigate is how a proof meets certain social standards, and whether the level of proof differs in a classroom and in journal writings. While the initial obvious response to the latter question is that journal
audiences are more demanding, the important issue is how the different level of proof alters the message.

Secondly, this analysis has certified mathematics as a human practice or cultural institution (Tymoczko 63). The *Standards* are a cultural artifact suitable for rhetorical analysis. It is my contention that the underlying mathematics is also a cultural artifact, subject to rhetorical analysis. Indeed, "mathematics is a collective work of art that derives its objectivity through social interaction" (Rav 92-93). The ways in which mathematics obtains its objectivity through classroom and other discursive practices is worthy of further attention.

**Conclusion:**

The role of standards in the practice of academic disciplines is quite important. Bazerman suggests that professional standards play a role in determining which informative anecdotes are acceptable. The problem with the *Standards* is that the anecdotes certified as "acceptable" do not always explain the assumptions and the hypotheses of the text, or are not always clear to those reading the standards. While it has been suggested that strategic ambiguity can serve an important function in discourse, I would contend that the part of the reasons the *Standards* have not yet succeeded is because there is too much ambiguity about how they are to be enacted in K-12 classrooms.
This study has also initiated the process of identifying the rhetoric of mathematics, by beginning the search within a specific discourse community. Further research should explore other mathematical communities, such as practicing mathematicians, children learning mathematics, and so forth, in order to identify distinctive features of mathematical discourse within those communities. We must also investigate how each community communicates about mathematics to other communities. Two different areas of mathematics education research, math anxiety and intercultural research, suggest possible research avenues. The math anxiety literature suggests profitable avenues of research that include ethnographic and narrative studies. The intercultural literature shows that children and parents in other countries speak about mathematics in different ways than American children and parents. One of the most obvious is in terms of who is capable of doing well in mathematics; many Japanese parents see success in mathematics as being based on hard work, while American parents are likely to suggest ability plays a large role in a child's success. Further research will identify what changes have taken place that alter the discourse patterns within communities, and could propose ways in which we might alter discourse structures in order to effect changes.

Finally, this project posits that we must look to the classroom to investigate how public discourse is shaped about
mathematics. By the eighth grade, if not earlier, children have already decided whether or not they enjoy mathematics as an academic subject. It would appear that public discourse about mathematics is shaped very early in life, and reinforced in high school and beyond. This provides rhetorical scholars with new locations with which to base theory. Most rhetorical theories assume implicitly adult audiences, and few investigate the role of children in discursive practice. The NCTM Standards clearly try to shape mathematical discourse at the K-8 level, and thus, we must at least investigate how persuasive theories change for children.

Finally, we must investigate the way in which the rhetoric of mathematics impacts the rhetoric of science. Since science is mathematical at its core, it is important for rhetoricians of science to consider the way in which the rhetoric of mathematics impacts the rhetoric of science.

Notes:
1. Admittedly, this study is highly regionalized, for it covers a specific band that links Madison, Wisconsin through Chicago, and around Lake Michigan to include sections of Indiana and lower Michigan.

2. The Curriculum and Evaluation Standards have already been sent to be revised, with an anticipated publishing date of 1997.

3. This was true at the .001 confidence level. See their article, op. cit., p. 384.
4. Again, this study suffers from a great weakness: the questionnaire was sent to 100 elementary school principals, who gave it to five teachers in their schools. Additionally, the study only covered grades K-4.

5. This is a translation from the Spanish that appears in the actual text: "¿Cuándo vas a aprender matemáticas en serio?" (Assessment 120)

6. Another translation from the Spanish in the text: "Pero todavía no estoy seguro que Marisol está aprendiendo todo lo que necesita aprender" (121).

7. The cold fusion controversy is one of many examples.

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