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"i'm Not Good at Math": Mathematical Illiteracy and Innummeracy in the United States

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“I’M NOT GOOD AT MATH”: MATHEMATICAL ILLITERACY

AND INNUMERACY IN THE UNITED STATES

by

GERALD WESLEY ROGERS

(Under the Direction of John Weaver)

ABSTRACT

Why do we view mathematics the way we do in the United States and how have these views created an environment where we consider mathematical illiteracy and innumeracy socially and culturally acceptable when a lack of this knowledge and ability can function to enslave, exploit, restrict, and oppress. Throughout this investigation, I have explored some of the possible reasons for why we view education, mathematics, and the learning of mathematics the way we do and the impact of these views on our motivation and desire to learn mathematics. Using my over 20 years of teaching experience and the review of literature from writers such as Brent Davis, Peter Appelbaum, Susan Jacoby, Paul Ernest, Eric Gutstein, Fordham and Ogbu, Valerie Walkerdine, David Jardine, Winthrop Jordan, John Paulos, Edward Said, Antonio Gramsci, Paulo Freire, Stuart Hall, and many others, I investigated the influence of mathematics as a discipline, mathematics curriculum and pedagogy, race, gender, social class, standardized tests, intellectuals, anti-intellectuals, anti-intellectualism, and our various social and cultural institutions such as schools, teachers, the family, peers and peer culture, the mass media, and the corporate order in historically, socially, and culturally constructing, shaping, and reinforcing our views. These views have resulted in an environment where people have no desire or motivation to learn mathematics even though a lack of this ability may be detrimental to the individual as well as their communities. Finally, I envision a different world of/in/with mathematics that can

hopefully help us find solutions for many of the issues associated with mathematics education in the United States.

INDEX WORDS: Dissertation, Mathematics, Mathematical illiteracy, Innumeracy, Cultural Studies, Postmodernism, College of Graduate Studies, Student, Graduate degree, Georgia Southern University

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DEDICATION

This dissertation is dedicated to my family, friends, and peers, who have encouraged me and given me the motivation and desire to succeed.

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First and foremost, I would like to express my appreciation to my committee: Dr. John Weaver, committee chair, Dr. Ming Fang He, Dr. Marla Morris, and Dr. Donna Saye. I would like to thank them all for their encouragement and patience. In addition, I would like to thank all of the teachers and people I have met throughout this program at Georgia Southern University, for helping to open my eyes to a whole new world of learning and experience to see the world in a totally new perspective. This accomplishment has been one of the most difficult and one of the most rewarding experiences in my life. I would like to thank all of my colleagues for their help and support throughout this long journey. I really enjoy many of our discussions on mathematics and education and hope they continue in the future. In conclusion I would like to thank all my families and friends for their sacrifice during this project.

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CHAPTER 1

“I’M NOT GOOD AT MATH”: MATHEMATICAL ILLITERACY

AND INNUMERACY IN THE UNITED STATES

Why do we view education and mathematics the way we do in the United States and how have these views created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate and accept poor math skills as the norm? For example, if a person is mathematically illiterate, they have an inability to recognize and understand basic mathematical signs, symbols, and operations, and lack the necessary problem solving and critical thinking skills necessary to function in society. According to Paulos in *Innumeracy: Mathematical illiteracy and its consequences* (2001), an innumerate person has “an inability to deal comfortably with the fundamental notions of number and chance” (p. 3). Without this knowledge and ability, people risk being easily misled, manipulated, and taken advantage of with numbers. Nevertheless, “a sizable minority of adult Americans wouldn’t be able to pass a simple test on percentages, decimals, fractions, and conversions from one to another” (Paulos, 2001, p.164). Many of my students find these basic mathematical computations very difficult. But why? Aren’t these skills and knowledge necessary for a person to make informed educated decisions? Furthermore, if we consider ourselves a just society, it would be in our best interest for everyone to become mathematically literate and numerate because although mathematical knowledge and ability can be liberating and empowering, a lack of this knowledge can function to enslave, exploit, and oppress.

What are my issues and concerns?

As a teacher, I am concerned about the many contradictions that exist in the way our U.S. culture and society views education and our current reality, because our actions aren’t consistent

with our rhetoric. For example, isn't it strange that people in our society claim to value education and consider knowledge and learning important; however, overwhelming numbers of people fear, loathe, and despise anything perceived as learning. They often rationalize why learning is not the social or cultural norm and commonly make statements about how learning something new makes their heads hurt. However this type of rhetoric when consumed by the masses, creates an anti-intellectualist sentiment so widespread that learning and the acquisition of knowledge are perceived as some type of punishment or torture. The question is why? The acquisition of knowledge is necessary for a person to reach their full human potential and transform society for the better. Nevertheless, we still have schools that are in serious disrepair and should be condemned; teachers who are not qualified to teach their respective subjects, or who don't care anything about the education of our youth but only teach because it is a job; a lottery for kids in poverty so that they can have a chance to attend a good school; a staggering drop-out rate, inequality, and social injustice on a grand scale. Why?

How can this be when we are told time and time again that in the United States everyone is entitled to an equal and quality education? The only problem with this premise is almost nothing is "equal," because we live in a capitalist society of winners and losers or what Peter McLaren in *Capitalist and conquerors* calls "capitalist accumulation of a winner-take-all variety" (2005, p. 23); a society where competition trumps equality and the winners always have more than the losers. A society where according to Freire (2004), "money is the measure of all things, and profit the primary goal. For the oppressor, what is worthwhile is to have more—always more—even at the cost of the oppressed having less or having nothing" (p. 58). From my experiences, I would have to say that most of the time when money is involved, the idea of fair, equal, and unbiased is quickly diminished. I agree with Mary Doll (2000) that "when some have

more power (influence, money) than others, the scales of justice do not balance” (p.198). Money and power are highly associated with academic success and the value we place on learning. For example, "there is solid evidence that SAT scores correlate primarily not with academic promise but with family income" (Taubman, 2009, p. 21). Furthermore, in our capitalist society, knowledge is associated with money and power, therefore people will do anything to have a competitive advantage and if that means acquiring more knowledge than others, or finding ways to limit and control what knowledge is acquired by the masses, they will make it happen.

Therefore this leads me to believe that there are people who don't want or don't care about an educated populist, because an educated populist is considered a threat to their power and influence, a threat to the establishment. For example, the establishment understands that knowledge is power, the great equalizer, therefore to maintain control of the masses, they find ways to restrict what knowledge is made available or convince people that the knowledge is not worth the time or effort to learn. However, these types of attitudes seem counter-productive to a democracy because the only way a democracy can survive is if the populace is educated enough to make informed, thoughtful, and critically sound decisions and not be easily manipulated. The problem is “a great many Americans lack the knowledge needed to make informed decisions about public affairs” (Jacoby, 2008, p. 297). But why? In whose best interest is it that we have an uneducated populace? Since according to McLaren (1989) the dominant culture is those “social practices and representations that affirm the central values, interests, and concerns of the social class in control of the material and symbolic wealth of society” (p.172), I would have to say it is in the dominant culture's best interests to control the amount of knowledge available to the masses as a means of maintaining current power relations and the status quo. According to Scott, in *How Higher Education in the US Was Destroyed in 5 Basic Steps*, it is in the best interest of

“the corporations, the war-mongers, those in our society who would keep us divided based on our race, our gender, our sexual orientation” (2012).

Furthermore, in our capitalist system, education is typically associated with labor power and therefore more education usually translates into more economic power. Statistically speaking college graduates will make more money over their working careers than a high school graduate. A high school graduate will have more economic power than a high school drop-out. People who lack this power can be manipulated and exploited economically and restricted to the low-skill, low-pay jobs. For example, according to Gutstein in *The politics of mathematics education in the United States: dominant and counter agendas* (2009), “over 71 million jobs, close to half of all jobs, ...[are] filled by workers with at most a 12th-grade education-including millions who did not finish high school” (p. 148). These statistics show motive for why everyone doesn't receive an equal education, because if everyone is educated who will do these low-pay, low-skill jobs? Furthermore, the dominant culture needs a means or method to make sure that at least half of our workforce only receives a high school education or less, and convince these people that their desire to remain uneducated is their choice.

For instance, according to Appelbaum in *Popular culture, educational discourse, and mathematics*, the dominant ideology works very hard to convince the masses that “everyone has a chance to rise up through the class, economic, and power systems. Those who do not rise (by definition, the majority) have failed to their own ‘natural’ deficiencies” (p. 116). This ideology contends that everyone starts on equal footing, and if a person is not successful it is their own fault. However, this ideology is flawed because there are many people who never receive an equal chance, nonetheless when they fail, they are made to believe it is their fault and not the inequities in resources and power. “Submerged in reality, the oppressed cannot perceive clearly

the ‘order’ which serves the interests of the oppressors whose image they have internalized” (Friere, 2004, p. 62). Once people believe that their situations are of their own making, they will never voice any opposition to working humiliating jobs for low-pay with no possibility of moving up the socioeconomic ladder. The dominant ideology creates the perception and convinces the populace that everything is fair, when in reality, it’s not.

Although people in our society are constantly inundated with rhetoric about the importance of education, the truth is there are large numbers of uneducated people. The people in power and the dominant culture often hide these facts from the masses and “use their ‘humanitarianism’ to preserve a profitable situation” (Friere, 2004, p. 73). Their dilemma has to do with creating the perception of supporting education while in reality obscuring knowledge. For example, with every one of a certain age being required to attend school and the possibility that they may learn something while there, how could someone influence the level of knowledge a person may acquire or the amount of learning taking place? According to Scott (2012), one way to accomplish this is “you dumb-down and destroy the quality of the education so that no one on campus is really learning to think, to question, to reason.” Presently our schools articulated with popular culture and mass media work very well at dumbing-down the populace by convincing people not to seek out available knowledge, or that ignorance is bliss. This is why according to Susan Jacoby in a Washington post article titled *The Dumbing of America*, “we’re a nation of dunces.” Without this knowledge people will be unable to critically investigate and thoroughly analyze all of the data and information that we are all confronted with every day and Scott (2012) warns us that “the result is a more easily manipulated citizenry, less capable of deep interrogation and investigation of the establishment ‘message.’”

As a mathematics teacher, I am deeply concerned about the contradictory nature of our

social and cultural views of mathematics, and our present reality and how these views impact the teaching and learning of mathematics. For example, most people, when asked, would tell you that they believe mathematical knowledge and skill are very important and believe that one of the major reasons for teaching mathematics is to help our populace process the vast amounts of numerical information present in our daily lives. Without a basic level of mathematical literacy and numeracy, a person could be easily influenced and manipulated with mathematical jargon articulated with junk or pseudo-science. Jacoby (2008, 2008a) and Paulos (2001) argue that people need to be numerate in order to see through the lies of pseudoscience which uses math to make unsound arguments. For instance, “mathematics is the quintessential way to make impressive-sounding claims which are devoid of factual content ... [therefore,] it's perhaps not surprising that it is an ingredient in a number of pseudo-sciences” (Paulos, 2001, p. 70).

Understanding that most people are mathematically illiterate and innumerate, junk science uses math to obscure the understanding of just about any issue and convince people to take action on the basis of flawed mathematical calculations or flawed statistical data. Therefore, people need to be mathematically literate and numerate in order to make the informed educated decisions needed to function in society and avoid being easily manipulated to do things that are detrimental to themselves and their communities.

Many argue that mathematical knowledge and problem solving skills are vital for success in the 21st century and students who lack these basic skills will find it hard to compete in a global workforce. “Global competition” according to Taubman in *Teaching by Numbers* is “a phrase that haunts the language shaping education today” (p. 59). For instance, when discussing the reasons for teaching mathematics, global competition is almost always on top of the list. This is due, according to Gutstein (2006), because of the way the National Council of Teachers of

Mathematics (NCTM) “has framed mathematical literacy largely from the perspective of U.S. economic competitiveness in the global order” (p. 11). This is why, according to Brent Davis in *Teaching Mathematics*, “success in the study of mathematics has somehow become closely linked to our nation’s economic prosperity” (1996, p. 146), as well as our individual economic prosperity. Nevertheless, the earth is becoming smaller and smaller making global competition a reality. In the past we only had to compete with our neighbors and people throughout our country, however today we live in a global economy where everyone on the entire planet will be competing for the limited number of jobs and resources. Although mathematics hones critical thinking and problem-solving skills which can help a person in solving not just mathematical problems but the many problems of life, fewer and fewer students are studying these subjects, and Battista (1999) warns us that, “the mathematical ignorance of our citizenry seriously handicaps our nation in a competitive and increasingly technological global marketplace” (p. 425). According to Taubman (2009), “Thomas Friedman's *The World Is Flat*. . . presents a dire picture of the US workforce, arguing that it is ill-prepared to face a global economy” (p. 73). However, these assumptions seem contradictory because if mathematics is so important why do we find it socially and culturally acceptable for our citizens to be mathematically illiterate and innumerate?

Math is everywhere in our culture. However, if we were to give a basic math skills test to everyone in the country, I don’t believe the numbers would be up to par. As a matter of fact, they would be downright ugly. Why? For most people, in order to exist and function in everyday life, a person needs basic math skills in order to count money, compute their wages, maintain a checking account, and interpret basic facts and figures in order to prevent being cheated or to catch common errors that arise in everyday activities. For example, in the small town where I

live, it is sad but there are still large numbers of citizens who are illiterate. I still see people of all races, genders, and economic status signing their checks by making their mark. For those unfamiliar with this terminology, when a person can't read or write they put an "x" or some mark on their checks as their endorsement. Because they can't read, many look at pictures on the menus of local restaurants to place their order. Although, some of these people can actually do basic arithmetic, there are still others who can't read, write, or do arithmetic. These are people who find it difficult in society and are left to the mercy of others not to take advantage of them. What happens when a person needs every last penny of their money to survive but the attendant at a cash register gives incorrect change and short changes the person by twenty bucks? The person never knows they were shorted because they can't count their change. I have seen people go for months being cheated on their payroll checks because they can't compute the number of hours worked times the pay rate in order to calculate how much pay they should receive. At one job where I worked, the controller who wrote the checks was embezzling money not from the company but from the workers and many of the employees never noticed they were missing money on each paycheck. The controller was smart and only took money from people she considered illiterate or not too bright, however, many of these people needed every dime to survive. This went on for close to a year. Is this what we consider a fair and just society? I think not.

This is why we need everyone to be educated in mathematics if we have any hope of creating a more democratic, morally just society. For example, many of the values of a democracy include freedom, individual rights, equality, and educated populace. However, it is questionable if we as a nation still hold to these values. In a functional democracy, people participate by voicing their opinions on issues of their concern or of concern to the people in

order to reach a consensus on the best course of action. After the best course of action is determined, the people get their opportunity to vote and the majority rules. Therefore, an educated populace is a starting point in fulfilling the dreams of democracy. In *Democracy and Education* (1916), Dewey talks about how democracy and education can break down barriers of class, race, and national territory and how democracy should be devoted to education because "the government resting upon popular suffrage cannot be successful unless those who elect and who obey their governors are educated" (p. 104). For example, a democracy requires an educated and informed electorate who understands the essential elements of how a democracy functions. Many people may be future leaders in a democracy and therefore need to understand the pros and cons as well as understand the structure and pragmatic workings of democratic society such as finance, law, civics, and government. However, in *The Age of American Unreason*, Susan Jacoby posits "many graduates of the nation's most prestigious universities, have a shaky grasp not only of basic mathematics and science but of the milestones of the nation's history and the fundamental ideas and structures on which their government rests" (p. 299). However this is nothing new because in 1997 Marciano in *Civic illiteracy and education* warned us about the civic illiteracy of our youth, and here we are almost two decades later, and we still face the same issues. Furthermore, according to Gutstein (2006), a "limited mathematical understanding can prevent students from more fully grasping important political ideas" (p. 29). Therefore, if we can solve the problems of mathematical illiteracy and innumeracy then maybe we can find solutions to civic literacy.

According to Ernest (2009), "mathematics is a highly democratic rational discipline in which knowledge is accepted or rejected on the basis of logic, not authority. ... [and can be used as] a tool for democracy in the hands of every educated citizen" (p. 59). Mathematics can give a

person the ability to critically think, analyze, and reflect in order to better understand and discuss issues such as basic civil and human rights as well as basic economic and personal freedom. Education is the only way to make our world a better place. In order for democracy to flourish, it is important that the entire population is educated enough to make critically informed decisions and not be easily manipulated. Without an adequate knowledge of mathematics, a person can be very easily misled and manipulated. Furthermore, if we had never acquired our mathematical knowledge and skill, the world would be completely different. For example, without scientific, mathematical, and technical knowledge, there would be no chance for democracy because we would be powerless against tyrants and dictators. Mathematics is needed “to protect the rights and interests of citizens themselves, and also to protect the more vulnerable in society, unable to do this for themselves” (Ernest, 2009, p. 61).

Once a person has this knowledge and skill they have a better understanding of how to make one’s voice heard. These skills are necessary if our ideas of democracy are to survive because “mathematics has always shaped our world and how we interact with it. It helps us understand history, literature, sociology, and many more aspects of our civilization” (Gutstein, 2006, p. 170). However, most people have very negative attitudes and perceptions about mathematics and these attitudes and perceptions work to create a self-fulfilling prophecy that destroys almost any chance for these students to be successful academically or to learn the math necessary to make educated informed decisions so vital for the existence of a democracy. Therefore, a lack of mathematical ability can be very detrimental to their success and our democracy.

So how much math must a person know? According to Davis (1996), “beyond basic arithmetic, it would be difficult to name anything as essential” (p.144). However, this would

depend on the definition of basic arithmetic. If basic arithmetic is defined as the ability to add, subtract, multiply, and divide real numbers, I would have to disagree. If a person is going to function as a critically thinking productive citizen, these skills are only the start. We should teach people the mathematical knowledge and skills necessary to understand and function in the world as it is. For example,

in an increasingly complex world full of senseless coincidence, what's required in many situations is not more facts – we're inundated already – but a better command of known facts, and for this a course in probability is invaluable. ...probability, like logic, is not just for mathematicians anymore. It permeates our lives. (Paulos, 2001, p.178)

I also agree with D'Ambrosio (2009), that all members of a society do not have to be

skilled in academic mathematics, which is mostly irrelevant for the average person.

However, it is relevant for all to acquire the communicative, analytic, and material instruments that are literacy, numeracy, technoracy. These abilities and dispositions are essential if the individual is to attain full citizenship, and mathematics education makes essential contributions to that role. (p. ix)

We should determine the skills and knowledge needed to exist and survive in the adult world and construct the curriculum accordingly.

A person must have the knowledge and skills necessary to interpret, evaluate, and critically understand the mathematics around them and be able to function as an educated and informed citizen who is not easily manipulated. Ernest (2009) posits that our citizens should be able to critically understand

the uses of mathematics in society: to identify, interpret, evaluate, and critique the mathematics embedded in social, commercial, and political systems and claims, from

advertisements, such as in the financial sector, the government and interest group pronouncements. Mathematics is very widely used to express and support claims and its use lends an authority to advertisements, reports, and press releases. Every citizen in modern society needs to be able to analyze, question, critique, and understand the limits and validity of such uses, and where necessary reject spurious or misleading claims. (p. 61)

According to Gutstein (2006), people need the mathematical knowledge and ability “*to investigate and critique injustice, and to challenge, in words and actions, oppressive structures and acts – that is, to ‘read and write the world’ with mathematics*” (p. 4). After the students can master these basic skills necessary to function and survive in society, we can expand and move towards the more complex areas of mathematics.

Mathematical knowledge and ability give people the power to function as critically thinking productive intellectuals capable of liberating themselves and their communities. Therefore, I find it rather suspicious that we live in a society where mathematical skill and ability can translate into social and economic power, but no one wishes to acquire such knowledge. Furthermore, overwhelming numbers of people lack mathematical knowledge and ability and although this can cause an extreme hardship on them and their families, we still consider this socially and culturally acceptable. Many people believe it acceptable to score lower grades in math classes because math is considered one of the hardest subjects in school. This perception of “hard” means that it is very rigorous and usually takes a long time to master. I’ve heard many people talk about the difficulty of mathematics as compared to other subjects. Why do people feel this way? Is it because of the structure of mathematics as a discipline, or the traditional mathematics pedagogy and curriculum? Is it because of cultural and social forces out to control

the masses?

As a mathematics teacher, I am deeply concerned about the role our various social and cultural institutions all play in constructing and reinforcing stories, myths, perceptions, attitudes, and stereotypes about mathematics, mathematics education, and people who possess mathematical ability that have a major impact on the teaching and learning of mathematics. Although these attitudes and perceptions could have a positive or negative impact on the teaching and learning of mathematics and on mathematics education and pedagogy, most of the time the impact is negative. But why? Is it possible that these negative views have been historically, socially, and culturally constructed through some natural evolution or for some sinister hegemonic reasons? For example, some people have constructed their views of math from previous experiences, however, many have constructed and reinforced their views through stories, myths, and anti-intellectualist rhetoric mostly consisting of misinformation and, what Noam Chomsky calls propaganda, portraying math as a monster to be feared and avoided.

I can remember the same misinformation and propaganda about the dentist. For example, the first time that I ever went to the dentist, I was horrified. Not because of my previous experience with the dentist but because of all of the horror stories told by people who had been to the dentist before me. Through cultural and social interaction, I would hear story after story about how bad it was to go to the dentist. These interactions and stories functioned to create a perception in my mind that resulted in my fear of the dentist. In the days before my first appointment, I can remember facing severe anxiety and dread, consistent with the feelings of facing the hangman. However, after my first trip to the dentist, I realized that, although it wasn't pleasant, it wasn't as bad as I had imagined it to be. As I reflect on past experiences, I can truly say that all of the horror stories concerning math that I remember in my youth had a serious

impact on how I view mathematics. But just like the dentist, once I got past my fear and anxiety, I realized that math wasn't that bad and could actually be used in positive and practical ways.

Many people buy into all the myths and propaganda disseminated throughout our society and culture concerning mathematics that have a serious impact on the teaching and learning of mathematics. For example, some of the common myths are: "mathematics ability is inherent; ... mathematical insight comes instantly if it comes at all; ... only the very few can do mathematics; ... mathematics is a male domain" (Tobias, 1993, p.12). The elitists' myths that not everyone can do mathematics or that males perform better than females, whites perform better than blacks have been around throughout our history and reinforce the idea that most minorities including women, possess little or no innate ability to learn and perform simple mathematical tasks.

Although all of these myths are untrue, a large percentage of the populist still believe them to be fact. As I reflect on my past, I can remember being constantly bombarded with anti-intellectual rhetoric reinforcing these myths and stereotypes and have come to realize just how profound an influence these myths have had in shaping my views on education and mathematics, mostly in a negative way.

Anti-intellectualism articulated with the mass media and popular culture help to perpetuate these stories and myths which function to construct and reinforce negative stereotypes and attitudes about people who possess mathematical ability and skill that seriously impact the teaching and learning of mathematics. For example, these views have created an entire subculture of people who consider their lack of mathematical knowledge and skill a virtue, a *badge of honor*. For years now both in formal and informal settings when people ask what kind of work I do and I tell them I teach mathematics, I am always amazed at all of the negative reactions provoked by my reply. I can't remember very many people who did not openly laugh

and joke about their lack of mathematical ability and would comment “I don’t know how you could do such a thing, because I hate math.” Usually in a crowd, an entire subgroup of people will gladly claim that they have never been good at math. Many of my colleagues claim when they mention they are mathematicians anywhere, they get the same treatment.

I have heard people of every race, gender, socioeconomic status, or educational level, freely express their lack of mathematical ability. I have been in some very formal situations where prominent educated people would openly brag about their lack of mathematical skills. According to Davis (1996), it is not uncommon to hear “a parade of successful public figures flaunt their feelings of mathematical incompetence” (p. 145). Paulos (2001) posits

unlike other failings which are hidden, mathematical illiteracy is often flaunted: ‘I can’t even balance my checkbook.’ ‘I’m a people person, not a numbers person.’ Or ‘I always hated math.’ Part of the reason for this perverse pride in mathematical ignorance is that its consequences are not usually as obvious as are those of other weaknesses. (p. 4)

The problem is when people in our society hear others make comments like “I can’t do math” or “I have never been a math person”, these statements create and reinforce the perception that it is perfectly acceptable to be poorly skilled in mathematics.

But why is it okay to be mathematically illiterate and innumerate but not okay to be illiterate? You never hear someone saying “Wow, I wish that I could read.” There are many organizations that work to fight illiteracy because they believe that for a person to function in society they need to be able to read. But what about literacy in mathematics and a basic level of numeracy? Shouldn’t people have the skills and knowledge to read and understand numbers? Numbers have meaning and can also tell a story. However, Moses & Cobb (2001) state that in our culture, “illiteracy in math is acceptable the way illiteracy in reading and writing is

unacceptable. Failure is tolerated in math but not in English” (p. 9). Doesn't this seem a bit insane? Why is there a stigma attached to reading illiteracy that is nonexistent when it comes to math illiteracy? For example, when it comes to mathematical illiteracy and innumeracy, our culture just turns and looks away, nothing is ever said or done about the issue. But why, in a culture that claims to value mathematical ability, do we find this acceptable?

These cultural views come into play when students rationalize and justify the reasons why they don't need to learn math. The many myths and stories legitimize many of our negative attitudes and perceptions concerning math and because of this most people would go to extreme measures to avoid anything considered mathematical. I would love for more students to be interested in mathematics. The fact is, however, subjects like mathematics or science which often require a great amount of time to learn and master are avoided like the plague. This avoidance is reinforced by the fact that it is socially and culturally acceptable to do so. But why? From my experiences as a mathematician, I can truly say that some topics take a great deal of time, motivation, persistence, practice, patience, and hard work to learn and eventually reach a certain level of conceptual understanding. The problem is “the amount of free time devoted to a particular activity is an absolute measure of the cultural and personal value placed on that activity” (Jacoby, 2008, p. 255). Most people never spend any of their free time devoted to mathematical activities, therefore it is easy to see why in our society, both culturally and personally, math has no value.

As a mathematics teacher, I am deeply concerned about the contradictory nature of mathematics education and our current reality. For example, the purpose of mathematics education should be to empower and liberate students. For instance, "mathematics is important as a liberating intellectual force in our society, instead of being merely another instrument favoring

inequity, arrogance, and bigotry” (D’Ambrosio, p. xi). According to Ernest (2002), a person is mathematically empowered if they have an understanding of the “language, skills and practices of using and applying mathematics” (p.1). Ernest goes on to discuss how mathematics empowers us both socially and epistemologically. For example, a person is socially empowered if they can read the world with mathematics

to better one's life chances in study and work and to participate more fully in society through critical mathematical citizenship. Thus it involves the gaining of power over a broader social domain, including the worlds of work, life and social affairs.

Epistemological empowerment concerns the individual’s growth of confidence not only in using mathematics, but also a personal sense of power over the creation and validation of knowledge. (Ernest, 2002, pp.1 – 2)

Mathematical knowledge gives a person the power to evaluate “every numerical and financial calculation in terms of the correctness of the underlying mathematical reasoning” (Ernest, 2009 p. 59).

However, mathematics has become a tool for social and economic control, prejudice, and discrimination, a gateway that restricts a person’s access to power and prosperity. According to Moses and Cobb in *Radical Equations: civil rights from Mississippi to the Algebra Project*, math literacy is a civil rights struggle because

in today's world, economic access and full citizenship depend crucially on math and science literacy. ...the absence of math literacy in urban and rural communities throughout this country is an issue as urgent as the lack of registered Black voters in Mississippi was in 1961. (2001, p. 5)

In a capitalist society, people need some basic mathematical skills and numeracy to function and

without these skills they could suffer. So in a society where mathematical skill and ability can translate into economic success, why do we have so many people who are mathematically illiterate or innumerate? I would argue that we are socially and culturally constructed by previous experiences, misinformation, and propaganda, to view math the way we do. However, most of the time these views function to limit a person's motivation and desire to acquire mathematical knowledge. Without the necessary motivation and desire, a person may never learn any mathematical skills or knowledge. Therefore, this lack of desire leads to a lack of knowledge, and this lack of knowledge in conjunction with schools and standardized tests create a gateway of oppression.

For instance, "courses in mathematics have assumed a 'weeding out' role" (Davis, 1996, p. 145). They weed out the people who can't function mathematically. Taubman (2009) and Moses & Cobb (2001) consider mathematics a gatekeeper and a means to discriminate and oppress. However, in a country where mathematical ability can translate into personal success, a lack of mathematical ability can severely limit a student's potential and according to Freire (2004) "any situation in which 'A' objectively exploits 'B' or hinders his and her pursuit of self-affirmation as a responsible person is one of oppression" (p. 55). For many, the oppression starts in high school when they are forced to give up and drop out of school because they have never been able to successfully pass any math classes. Most of the students that I know, who have dropped out of school, tell me that they dropped out because they never could pass high school algebra. According to St. Julien (2005), "the high school algebra graduation requirement is the most dreaded Carnegie unit in American schools" (p. 113). According to Moses, West, & Davis (2009),

research on high schools with low graduation rates, [show that] ... African-American and

Latino/a students, [as well as] ... American Indian students, and White students [experience] difficulty with math concepts. Most states require mastery of beginning algebra in order for any student to obtain a high school diploma, but African-American, Latino/a, and American-Indian students graduate at a rate from 20 to 30% lower than White and Asian student's. (p. 242)

Therefore, without a fundamental knowledge of algebra, a person would find it difficult to graduate high school and study more advanced mathematical topics, thereby limiting what they may become. But why?

I have been teaching mathematics and statistics for many years now and an alarming number of my students struggle not because of the current class material, but because they have not acquired the high school level knowledge necessary for the challenges of studying math at the collegiate level. From my experience as a college mathematics teacher, I would have to say it is a combination of our social and cultural views of mathematics, the lack of good math teachers, and our current curriculum and pedagogy that many come to college with little or no math skills. For whatever the reasons, because they failed to gain the basic mathematical knowledge in primary and secondary school, students in basic college math classes struggle. It doesn't take standardized test scores to show us that students are not prepared for college level mathematics. Many of my college students find it difficult to solve the types of problems that are usually seen throughout elementary school. According to Paulos (2001), "high school is the time to reach students. After they get to college, it's often too late for many of them who lack adequate backgrounds in algebra and analytic geometry" (p. 106). However, I would have to disagree because I can say from personal experience that it is never too late.

Although the initial premise of standardized testing was to make sure all students reach a

certain level of competence and that no student would be left behind, these tests have become a primary tool of oppression. For example, low scores in school and on standardized tests can restrict a person's access to higher education and possible socioeconomic success. Today, standardized tests have become one of the major tools used as a method of weeding out certain individuals and "other than in terms of gate-keeping functions, however, *none* of the tests are correlated with college, professional, or economic success" (Taubman, 2009, p. 27). For many, ACT and SAT math scores as well as general math tests and especially standardized math tests have become tools used to restrict a person's ability to attend college as well as restrict people to certain fields of study or vocations which in essence limits their human potential. Many of these tests function as a means of discrimination hidden from view. For instance, scores on these tests construct and reinforce many of the stereotypes concerning race, gender, and social class and for many will determine their direction in life. By allowing this to happen, we as educators are doing our students an injustice of epic proportions. But why in a culture that claims to value mathematical ability do we find this acceptable?

Although some students can do a great job on standardized tests, many are still restricted to certain college degrees based solely on the math requirements. For instance, there are students who talk to their advisor or look in the University catalogue and choose a major, not because they like it or would enjoy working in the field but because that particular major only requires one math class. Paulos (2001) posits "women, in particular, may end up in lower paying fields because they do everything in their power to avoid a chemistry or an economics course with mathematics or statistics prerequisites" (p. 106). In my years of experience as an advisor, I never noticed a racial or gender bias because a large percentage of all students I advised decided their majors based solely on "what degrees require the minimum amount of mathematics." Although

some majors only require one basic math course, many students still find it very difficult to pass. Certainly, there would be more people studying in these areas if it wasn't for the math requirement. Therefore, their lack of mathematical knowledge becomes a barrier that severely limits what they can hope to accomplish in life and robs them of ever reaching their full potential, seeing the world in new and fascinating ways, being in the world, or working in certain fields. Not only are "Millions of Americans ... letting [their] fear of mathematics limit their career options" (Tobias, 1993, p. 14), they are also letting their fear limit who we may become as human beings. This fear can limit people from becoming doctors, scientists, or engineers who could someday find a cure for cancer, develop a new type of green energy or cold fusion reactor, or find new and innovative ways to safely feed all the people on the planet as well as make sure everyone has access to clean water. If we consider just a few of these issues, it is easy to see why so many people have little or no desire or motivation to learn math. Therefore, until our culture as a whole starts to value mathematics, there is no need to speak of things such as mathematics curriculum and pedagogy. There is no need in trying to construct a mathematics curriculum in a culture where math has no value and so few desire this knowledge, because all mathematics curricula are irrelevant if the knowledge is never learned by the student.

What is my plan and why is it important to curriculum studies and mathematics?

I plan to explore and examine why we view math the way we do in the United States, and how our perceptions and attitudes about mathematics and mathematics education have been historically, socially, and culturally constructed. I hope to ferret out why we find mathematical illiteracy and innumeracy culturally and socially acceptable, when these abilities can result in empowerment, liberation, economic access, and full citizenship, especially in view of the discriminatory way math is being used as a gatekeeper to enslave, exploit, and oppress. This

amounts to the cultural and social acceptance of discrimination and exploitation based on mathematical ability. Therefore, as a way to seek out social, political, and economic justice, I plan to explore and examine the many contradictions between how we are conditioned to view mathematics and reality, and who benefits. How is power associated with the construction of these attitudes and perceptions, and for what purpose? What impact do these views have on our motivation and desire to learn math? These issues are important to curriculum studies and mathematics because mathematics education in the United States has become a major social issue with serious practical and policy implications.

What does it mean for Theory?

Throughout this exploration, I will be viewing the world through the theoretical frameworks of Cultural Studies and Postmodernism. For example, I will assume that our social and cultural norms concerning mathematics have been historically, socially, and culturally constructed and reinforced and attempt to discover some of the possible ways this construction is carried out and why? In terms of theory, curriculum studies is interested in understanding curriculum as historical, political, institutional, racial, gendered, phenomenological, hermeneutical, autobiographical, postmodern, and poststructural text, all of which give us insight on how our views of mathematics, both positive and negative, are socially and culturally constructed, and why, and the role these views play in the teaching and learning of mathematics. I will examine the association between power, our views of mathematics, and the many grand narratives used to legitimize power relations, especially when it comes to gender, race, and socio-economic class.

Why Cultural Studies and Postmodernism?

Why cultural studies? There are several reasons why I have chosen cultural studies as a

theoretical framework for my research. For instance, I will examine and explore how our social and cultural norms are established and cultural studies is “a multi-disciplinary approach to the understanding of all dimensions of culture from traditional notions to popular culture” (Weaver, 2009, p. 22). In contemporary cultural studies,

culture is thought of as directly bound up with work and its organization; with relations of power and gender in the workplace, the home, the neighborhood, and the street; with the pleasures and the pressures of consumption; with the complex relations of class and kith and kin through which a sense of self and belonging is formed; and with the fantasies and desires through which social relations are carried and actively shaped. (Denzin & Lincoln, 2003, p. 491)

Therefore, cultural studies is a necessary component in gaining a better understanding of how culture establishes and shapes our commonly held set of norms or standards that are used to classify socially acceptable or unacceptable behavior.

Understanding math curriculum as historical text.

According to Denzin and Lincoln (2003), “cultural studies involves an examination of how the history people live is produced by structures that have been handed down from the past” (p. 250). Therefore, in chapter 2, I hope to add something to our understanding of math curriculum as historical text by exploring the role that math as a discipline, math curricula, teachers, pedagogy, and many of our social and cultural institutions have played historically in constructing our social and cultural views of mathematics. I plan to explore a brief history of curriculum and curriculum studies to determine the role that curriculum and pedagogy have played in constructing our attitudes and perceptions of mathematics and mathematics education, and how these views impact the teaching and learning of mathematics. I will examine our current

curriculum and pedagogy to see what role they have played in constructing our views of mathematics and the influence these views have on our motivation and desire to learn.

As a mathematics teacher, I am deeply concerned with how our historically, socially, and culturally constructed perceptions of mathematics have resulted in overwhelming numbers of people who fear, loathe, hate, and despise anything perceived as mathematical and are horrified at the idea of performing some mathematical task. Many speculate that our cultural and social acceptance of mathematical illiteracy and innumeracy are a result of the feelings of anxiety, fear, and hate associated with mathematics. For example, just the thought of mathematics can produce severe anxiety, and to some a form of primal fear that triggers a fight or flight response. Why does math evoke these types of emotional reactions and how much power do these emotions have on a student's desires to engage in learning mathematics? According to Hackworth (1985), "anxiety is learned and... is a normal human reaction to any situation the individual feels is threatening" (p. 15). So what is it about math that people consider threatening? Why has mathematics historically been a subject that creates a serious amount of anxiety, fear, and hate in people? Is it due to the nature of mathematics as a discipline, or the way mathematics is currently taught in schools? Is it because of previous experiences or propaganda? Is it because of some purposeful scheme or the natural evolution of our mathematics curriculum and pedagogy? This fear of mathematics is probably one of the main reasons why people never try to learn. What is most disturbing is the fact that historically fear has been used as a form of social control and the fear of mathematics and the anxiety it produces definitely functions to oppress.

Understanding math curriculum as political text.

As I look around the United States and the world, I notice that everything is political, especially the teaching and learning of mathematics. Scholars like Antonio Gramsci (1971),

Henry Giroux (1983), Michael Apple (2004), and Paulo Freire (2004) help us to understand mathematics curriculum politically and give us insight into the concept of power and how power operates to reproduce the dominant ideology and dominant culture. Therefore, using the cultural studies theoretical framework developed by the various notions, concepts, and ideas of the Frankfurt School and British Cultural Studies, I plan to explore and examine how mathematics has become associated with domination, power, reproduction of the dominant culture, resistance, and hegemony. All of these ideas are necessary components in critically analyzing and gaining a better understanding of my issues and concerns. For instance, the Frankfurt School and scholars such as Theodor Adorno, Herbert Marcuse, Walter Benjamin, and Max Horkheimer formulated ideas on education, power, culture, and politics. The Birmingham Centre of Contemporary Cultural Studies continued the work of the Frankfurt School with scholars such as Richard Hoggart, Raymond Williams, and Stuart Hall where they formulated ideas on subculture, popular culture, media studies, and literary and historical theory using an interdisciplinary approach of many different ideas and methodologies that are vital in understanding my issues.

One of the primary themes in curriculum as political text is that of domination and there is no doubt that mathematics is being used to dominate, oppress, and discriminate. According to Donald Bateman,

the central and primary theme of our age is domination: domination of the poor by the rich, Blacks, browns, reds, and yellows by whites, women by men, students by teachers.

It is called neocolonialism, imperialism, racism, sexism, all different though alike, related and interrelated in obvious and subtle ways (pp. 58-59). (Pinar, Reynolds, Slattery, & Taubman, 2004, p. 221)

However this is nothing new because this kind of domination has existed for millennia. For

example, the rich have always lived on the backs of the poor. The oppressor always lives on the backs of the oppressed. The question is: why? Therefore, I hope to add to the discourse on mathematics curriculum as political text in order to better understand how math has become a form of domination, a tool of oppression and social control, a gatekeeper used to weed out the inferior and reinforce and reproduce inequality and the status quo, many times, in terms of race, gender, and social class.

What does power have to do with how we view mathematics and how math has been used as a gatekeeper to weed out certain groups? Cultural Studies is important because I wish to explore and investigate the association between mathematics and power and how power operates to reproduce the dominant ideology and dominant culture as well as construct and reinforce our social and cultural views of mathematics and according to Weaver in *Popular Culture*, “power is a major component of any definition of Cultural Studies” (p. 23). Stuart Hall posits the core of cultural studies “consisted of many things but the interest in combining the study of symbolic forms and meanings with the study of power have always been at the center” (Hall, 1998). The scholars of the Frankfurt school and British cultural studies formulated many critical theories of power and according to Denzin & Lincoln (2000) these theories can help us “understand the various and complex ways that power operates to dominate and shape consciousness” (p. 283). I hope to use these theories “as a means of deconstructing the dominant culture” (Miller, 1992, p. 45) in order to understand how power shapes our views of math and how these views can be used to liberate or oppress.

Understanding math curriculum as racial and gendered text.

In chapter 3, I hope to add to the discourse concerning mathematics curriculum as racial and gendered text by critically examining and analyzing what role, if any, race and gender play

in shaping our beliefs, desires, values, and attitudes about math and the role that mathematics plays in shaping our views about gender and race. Has math become just another means to discriminate in terms of gender and race? How have these views functioned to legitimize and reproduce gender, racial, and class relations and what does the achievement gap have to do with these views? What role has social Darwinism and the eugenics movement played in constructing our views and for what reasons? I hope to establish a motive for why mathematics is being used as a tool to discriminate, exploit, and oppress. If I examine some of the notions of ethnomathematics, I believe they may help me answer questions concerning how cultural values can affect the teaching and learning of mathematics both positively and negatively.

Understanding math curriculum as institutional text.

In chapter 2 and chapter 5, I hope to gain a better understanding of mathematics curriculum as institutional text, by exploring how and why many of our social and cultural institutions such as schools and teachers, the family, peers and peer culture, the media, and major corporations shape and construct our views of mathematics both positively and negatively. What influence, if any, do these institutions have in constructing and reinforcing our perceptions, attitudes, and stereotypes about mathematics, mathematics education, and people who possess mathematical ability, and to what end? What impact do these views have on mathematics education, curriculum, and the teaching and learning of mathematics? What impact do these views have on our mathematical identities and our desire to learn mathematics? What institutional forces have the most influence in shaping our culture, society, or identity? Could an examination of these social and cultural forces give us some insight on why some people are good at math and some are bad? For instance, many of our social and cultural norms concerning mathematics are a direct result of our interaction with our various social and cultural institutions.

Reproduction of the dominant culture.

According to Michael Apple and Henry Giroux, many of our social and cultural institutions are responsible for reproducing the masses and provide the dominant ideology with a convenient means to convince people of their fate. Their correspondence theory says that institutional propaganda reproduces the economic and political order of society, and that institutions such as schools work to reproduce the dominant ideology (Apple, 1979; Giroux, 1981; Giroux, 1983). Many times this reproduction is carried out by a hidden curriculum that functions to shape and manipulate how we view the world. For instance, Wink posits that schools are notorious for using “hidden educational processes ... [to] impose the dominant ways of knowing on all” (2002, p. 56). According to Pinar et al. in *Understanding Curriculum* this is carried out by means of a hidden curriculum, “those unintended but quite real outcomes and features of the schooling process” (p. 248). It is disturbing how schools have become both a means and opportunity to control and condition the masses. For example, according to Gutstein (2006), Chicago area public schools educated the majority of their students for “low-skilled service-sector jobs or the military. Some who refuse to submit to the routinization, ‘education for stupidification’ (Macedo, 1994), and preparation for servitude were driven out to the margins, the streets, prison, gangs, or early deaths” (p. 211).

I can say from my experience, that schools and teachers play a major role in how we view mathematics, both good and bad. School is where most people are introduced to mathematics and start to develop their mathematical identities. Therefore, I believe that teachers have the power to shape a person’s views of mathematics in terms of their competence, confidence, and self-esteem that function to shape their mathematical identities and the pleasure or power they may achieve in the learning of mathematics. However, is it the teacher that makes the difference, or is it the

teaching methods? Does the curriculum or pedagogy matter? Does teaching imply learning? What is the difference between teachers who have the ability to motivate their students and those who don't? Although teachers do bear some responsibility for their student's success, students must also take responsibility. However, schools are only one of the many institutions with the power to reproduce the dominant culture. For example, according to the "Coleman Report (1966), ... school curriculum, instruction, and the like had little impact on scholastic achievement when compared with social economic status, home life, and peer culture" (Schubert et al., 2002, p. 195).

The Family

From my experiences, I have noticed that family plays a big role in how we view mathematics. The question is why? Is math ability genetic, a product of some social environment, or a combination of both? For example, what is the correlation between an individual and her/his parent's mathematical aptitude? My parents say there is no correlation, and if there were it skipped a generation, because they are terrible in math. Although I suppose genetics could play a role, I feel it has more to do with a person's environment and with how a person's family views mathematics because your family shapes your identity by giving you a basic set of values and beliefs which help define the way you look at the world and the way you look at mathematics. Typically, if some people in a person's family view math in a positive way, the individual will view math in a positive way. The family may also be responsible for the construction and reinforcement of negative attitudes and perceptions concerning mathematics. For example, according to Moses and Cobb (2001), parents help to reinforce our negative attitudes about math by saying things "like 'I never got the stuff either; do the best you can and try not to fail'" (p. 9). However, parental involvement is critical in developing positive

dispositions toward math.

Peers and Peer Culture.

Today many people are more concerned with what their peers are thinking than anything else and this determines everything from the clothes they wear, to the music they play, to the types of television shows they watch, to what they consider socially and culturally acceptable. A person's peers or peer culture all play a role in the construction of our identities, attitudes, and perceptions concerning mathematics that have a serious impact on the teaching and learning of math. For instance, "many students cannot admit to pleasure in classroom activities – it just would not be acceptable in front of their peers" (Appelbaum, p. 128). They claim that if they make good grades in mathematics or school in general they will become classified as geeks or nerds and become unpopular which could result in being bullied or assaulted. Therefore, we must recognize that peer pressure is a powerful force which can have a profound influence on an individual's views concerning mathematics.

Mass Media and the Corporate Order.

As I consider my experience with anti-intellectualism, the mass media, and the corporate order, I would have to say that they possess great power in shaping our negative perceptions of mathematics that seriously impact our motivation and desire to learn. It almost seems as though they are advocates for mathematical illiteracy and innumeracy, but why? Therefore, in chapter 4, I will attempt to gain a better understanding of the notion and responsibilities of an intellectual and how we as a culture view intellectuals. I will explore the history of anti-intellectualism in the United States and investigate its role in the social and cultural acceptance of mathematical illiteracy and innumeracy. What do our views of intellectuals have to do with mathematical illiteracy or innumeracy? For example, I seek to answer questions such as: what roles have

intellectuals and anti-intellectuals played in constructing our views of mathematics, or learning in general?

The mass media plays a major role in the construction of our attitudes and perceptions concerning the learning of mathematics because it shapes the way we view the world, and when articulated with the anti-intellectualism and the corporate order, shapes our popular culture and youth culture. Therefore, in chapter 5, I will explore the history of the mass media and determine how it has come to shape our views of math. I will look at the works of Walter Benjamin, Theodore Adorno, Max Horkheimer, Noam Chomsky, Stuart Hall, Dick Hebdige, and Raymond Williams, just to name a few, in an attempt to better understand the media's influence in shaping and reinforcing our culture and how we view the world and ourselves. According to Saukko (2003), "analyzing the ways in which discourses or ideologies shape how people see themselves and act in the world, has been a central part of the cultural studies project from the start" (p. 74). "Cultural studies proposed that expanding the ways of approaching media enabled a better grasp of formations of power and resistance, especially in the everyday reception of media texts" (Schwoch & White, p. 15).

Therefore, I plan to investigate the role that popular culture and the mass media play in constructing our attitudes, perceptions, and desires to learn math by performing a critical examination and deconstruction of various cultural products or discourses used to shape our mathematical identities ranging from television, radio, film, magazines, to digital information. The work of Stuart Hall, one of the most influential cultural, media, and political theorists of modern times, is necessary when considering the effects of the mass media on their audiences and the way these representations are interpreted. I hope to show the power of the mass media to influence many aspects of our lives including attitudes about education and mathematics.

Anti-intellectualism, mass media, and the corporate order are very powerful in shaping and constructing our views of mathematics and our mathematical identities. Therefore, I plan to explore and examine how the mass media articulated with the corporate order and anti-intellectualism has become very influential in shaping our social and cultural views of mathematics and learning in general, and how they have worked to create an atmosphere where education is perceived as a vice and not a virtue. However, corporations are notorious for using the mass media to spread their propaganda, misinformation, and anti-intellectual rhetoric and are great at devising divide and conquer strategies that create an ‘us against them’ mentality that keep the masses and certain groups of people in perpetual conflict in order to obscure reality all in the name of power and capitalist gain. According to Michael Apple in *Educating the right way*, when it comes to most corporations, “profits are much more important than the lives, hopes, and well-being of employees who have given their working lives to these organizations” (p.18). The mass media and the corporate order are responsible for constructing and reinforcing many of the myths and stereotypes concerning mathematics as well as the romantic notions of the rebel and the idea that it is ‘cool to be dumb’ that have become so firmly attached to our youth culture and popular culture. I guess if people are mathematically illiterate and innumerate the mass media and corporate order can more easily control the masses through misleading advertisements and propaganda.

It would definitely be in the best interests of gambling institutions for people to remain mathematically illiterate and innumerate. For example, if the masses understood basic probability and had the ability to compute the odds and expected value of many of the common gambling games, there would be no MGM Grand, Caesar’s Palace, or other gambling institutions because people would know that the odds are stacked against them at these places. If everyone

was math literate and possessed a small amount of numeracy, the lottery systems would go bankrupt, gambling institutions would lose their golden goose, and Vegas would disappear back into the desert. Therefore, it is definitely in the interests of these institutions to keep people mathematically illiterate and innumerate and to keep the mass perception of math as hard, bad, or evil, and that anyone good at it must be abnormal or possess some type of character flaw because that could lead to more people who insist that the games are fair or 50/50 and become easily conditioned to gambling.

Resistance

All of our social and cultural institutions have the power to construct, reproduce, and reinforce our social and cultural attitudes and perceptions of mathematics. They construct how we view mathematics and create an environment where math has no value and where it is perfectly acceptable to be mathematically illiterate and innumerate. The question is if the dominant culture seeks to control the masses by creating these negative views, why do some people love math? Although many of us are reproduced by the dominant culture, there are some people who resist. For example, Giroux indicated in *Theory and Resistance in Education* (1983) that although schools are institutions used to reproduce the dominant culture, students still find ways to resist. According to Schubert et al., Giroux's proposal for education reform, 'critical pedagogy,' "has its origins in the recognition that the hegemonic domination of youth does not automatically translate into ideological transmission. There are possibilities afforded in the resistances and contestations that those designated as learners employ to challenge conformity" (p. 364).

For example, not all people are so easily reproduced and become resistant to all entities they consider to be associated with this reproduction. Since schools today are seen as such an

entity, students form a resistance to all things associated with school. For example, many people resist learning math because math is associated with schools, and the schools are associated with the establishment and the reproduction of the dominant ideology. Also, the structure of schools today are very oppressive. "School is associated with enforcement" (Morris, 2006, p. 205).

However, all humans have a need to be self-determined, which means there is a natural tendency to choose one's direction in life, and when people are confined or oppressed both mentally and physically their natural tendency is to resist. Dropping out of school is the method of resistance for some students; however, for those who are forced to attend school by law, their only options for resistance are hostility towards schools, teachers, or learning in general. Furthermore, resistance might not take the form of rebellion to the dominant ideology, there could be other reasons. For instance, some students resist because success in school can be seen as a weakness or reduce their social status or popularity. I believe that most people resist learning mathematics because they are socially and culturally constructed to do so. The question is why?

One of the major scholars in resistance theory is Paul Willis, and in his text *Learning to labor* (1977), he gave the world a firsthand view of a dozen British working-class boys resisting becoming reproduced by the dominant ideology. According to Saukko (2003), Willis'

study explores the ways in which the lads create a counterculture that gives them a sense of superiority in relation to the conformist boys- or 'ear'oles', as the lads called them ... doing every sort of misdemeanor and getting away with doing as little work as possible became a source of pride for the lads particularly in relation to the 'ear'oles' who were seen to embody the school values. (p. 40)

The lads resisted the idea of school even though they knew it would lead them down the hard road of life. They rejected being reproduced by the dominant culture no matter the costs. The

lad's families and friends helped to perpetuate their feelings that school was a waste of time and irrelevant; however, their resistance just reproduced their social class. Many students are similar to the lads in that they feel mathematics is a waste of time and totally irrelevant in their lives. They never see the correlation between mathematics, economic access, and their lives. "Willis concludes that, eventually, this resistance does not challenge the 'real' structures of domination but, on the contrary, socializes the lads to become blue-collar workers" (Saukko, 2003, p. 41). Hence, reproduction causes resistance and resistance leads to reproduction. It is an endless cycle.

Some people resist learning mathematics because of previous experiences with teachers, teaching methods, and schools. For whatever reasons these students have never been given a chance to learn and a student can take only so much failure before she or he completely tune out anything to do with math. Evaluation and assessment are perceived as a form of humiliation and punishment where failure and incompetence are to be avoided. Many of these students are told over and over again that they just don't have the ability to be successful in math, one of the common myths that some teachers have come to believe, and it doesn't take long before their students start to believe it too. After constant failure from a lack of proper instruction and being told that they have no worth, they start to believe it and give up. According to Freire (2004), "so often do they hear that they are good for nothing, know nothing and are incapable of learning anything-that they are sick, lazy, and unproductive-that in the end they become convinced of their own unfitness" (p. 63). However, Freire warns us that this self-depreciation is a major characteristic of the oppressed.

Hegemony

Many people never question their reproduction and never resist, but why? In order to answer these questions, I need to draw on Italian Marxist Antonio Gramsci's theories on

hegemony. According to Gramsci (1971) hegemony is the willingness of one social group to dominate and control other social groups without the oppressed groups realizing their oppression. According to Schubert et al.,

Hegemony is the process whereby a society or power dominant culture reproduces patterns of inequity. Each institution of the society, schools being prominent, passes along the hierarchical structure of society. Students of a given race, social class, or gender, for instance, are given messages, through the overt, hidden, and null curriculum that reinforce social inequalities. (p. 269)

Hegemony is nothing new, in fact, it has been used extensively throughout history as a means of mass control “not by physical force which may start a revolution but through social psychological attempts to win people’s consent to domination through cultural institutions such as the media, the schools, the family, and the church” (Denzin & Lincoln, 2000, p. 283).

Hegemony allows the dominant ideology to control and shape human consciousness thereby legitimizing their power relations with the masses.

Furthermore, hegemony gives people the illusion of self-determination while in reality the oppressors maintain their interests and dominance. They convince people that they are in control of their own lives when in fact they are not. “Hegemony works both through silences and repetition in naturalizing the dominant worldview” (Kincheloe and McLaren, 2003, p. 471). For instance, today many people take mathematical ability for granted and consider a lack of mathematical knowledge or ability the norm. However, could our norms concerning mathematics be a result of hegemonic reproduction? People believe that they are deciding for themselves what knowledge is of most worth when in reality they are being controlled. For example, people are free to decide if they want to study math or not, but because of our historically, socially, and

culturally constructed views of mathematics most people have no desire to learn math. However, this group never realizes how their lack of mathematical knowledge and ability is being used to oppress them. They never realize how their lack of mathematical ability and knowledge work to restrict and limit them from reaching their full potential.

Nevertheless, there are some people that resist this hegemony. According to Kincheloe and McLaren (2003), “there may also exist oppositional ideologies among subordinate or subaltern groups-whether well-formed or loosely articulated-that break free of hegemony. In this way hegemony is never total or complete; it is always porous” (p. 471). However, resistance is futile because although there are some people who have noticed how math is being used to discriminate and resisted, the dominant ideology expects and actually counts on people rebelling and resisting mathematics education, which in turn guarantees their hegemonic reproduction. The power of hegemony is that even if you resist, you are still reproduced. Hegemony, I feel, is stronger today than it has ever been and as technology advances to bring us new types of media, it will get even stronger. For example, I have noticed how the dominant hegemonic culture in connection with the media manipulate, mislead, and even lie to protect their interests. As Paulo Freire (2004) reminds us, the powerful want to remain in power and will do anything, at any cost, to keep it no matter the consequences. The only problem that the dominant power has is that this reproduction is not carried out on everyone.

When examining these issues through a postmodern framework, I will consider that all knowledge, concepts, or ideas as well as our views and attitudes about mathematics are historically, culturally, and socially constructed. I will consider a social constructivist view as described by Peter Berger and Thomas Luckmann in *The Social Construction of Reality*. They give us insight on how we construct our perceptions of reality and on how social phenomena are

created and eventually become the norm. They talk about how culture and society are in constant flux, dynamic and evolving, constantly being reproduced and refigured and how through social interaction our views and norms are made legitimate. As Eagleton (1991) states:

A dominant power may legitimate itself by *promoting* beliefs and values congenial to it; *naturalizing* and *universalizing* such beliefs so as to render them self-evident and apparently inevitable; *denigrating* ideas which might challenge it; *excluding* rival forms of thought... and *obscuring* social reality in ways convenient to itself (p. 7).

Because we are all products of our social and cultural construction, we are conditioned by norms or ideas that on the surface may seem natural and obvious to the many that accept this reality, when in fact these ideas are simply some cultural construct of society.

As Plato once remarked, the one who tells the stories is the one that shapes the culture and that is why throughout the history of humans, there have been many myths or grand narratives designed to legitimize cultural reproduction and domination. Math is definitely a combination of many grand narratives, and today our views of math have worked to legitimize poor math skills as the norm, but why? I seek to better understand what events, beliefs, attitudes, social structures, or policies help to shape our views about mathematics education and for what purpose. The dominant power convinces people that if you lack basic math skills you have no one to blame but yourself. It has nothing to do with the social realities and when it comes to mathematics education, the dominant power is quick to challenge any reform efforts that may be used to tear down the barriers or actually teach the material in the first place. One thing that we cannot deny is that our views and attitudes about mathematics as well as our social and cultural acceptance of mathematical illiteracy and innumeracy are a direct result of these culturally and socially constructed realities made legitimate through grand narratives.

Cultural studies and postmodernism are important because, I will be conducting a critical investigation through a review of literature and various other texts in order to gain a better understanding of how and why we view mathematics the way we do in the United States and how these views impact the teaching and learning of mathematics. What types of texts shape our views of mathematics? Is it oral dialogue, radio, music, movies, television, newspaper, magazines, books, or various other media? What types of texts create the perception that math is hard, most people can't do it, people good in math are not cool, and mathematical illiteracy and innumeracy are socially and culturally acceptable? What types of texts legitimize our social and cultural norms concerning mathematics?

I plan on using a particular technique of textual analysis, consistent with that of cultural studies, "which seeks to locate the text within its historical, material and cultural context [and] cannot be separated from the circumstances and conditions of their production and consumption" (Lewis, 2002, p. 35). According to Denzin and Lincoln (2003),

each version of cultural studies is joined by a threefold concern with cultural texts, lived experience, and the articulated relationship between texts and everyday life. Within the cultural texts tradition, some scholars examine the mass media and popular culture as sites where history, ideology, and subjective experiences come together. ... Other scholars read texts as sites where hegemonic meanings are produced, distributed, and consumed. (p. 250)

Viewing the world through a cultural studies and postmodern lens, I seek to examine various texts to determine how hegemonic meanings concerning math are produced, distributed, and consumed and how these texts function as a means of domination, as a means of social control. What narratives give a negative perception of mathematics or school in general? What narratives

create an environment where a negative attitude in mathematics is legitimized and made to seem the norm?

By examining various texts, I hope to gain a better understanding of the contradictions associated with our perceptions of math, and reality, in hopes of unraveling “the hidden dichotomous norms embedded in texts or discourses” (Saukko, 2003, p.10) that creates an environment where it is culturally and socially acceptable to be mathematically illiterate and innumerate. For example, I need to consider the context in which statements are made that have a negative influence on mathematics literacy. What did these statements mean at the time of their construction? What groups used these statements? What discourses have constructed the negative perception of mathematics? What experiences construct a person’s mathematically identity? Since the mass media has the power to disseminate these myths and grand narratives to a larger number of people, it is becoming a powerful tool in the cultural reproduction and domination of the masses.

In *Postmodernism as Border Pedagogy*, Henry Giroux posits that postmodernism can be viewed as equipping critical pedagogues with

a new set of theoretical tools for ...[raising] important questions about how narratives get constructed, what they mean, how they regulate particular forms of moral and social experience, and how they presuppose and embody particular epistemological and political views of the world. (1991, pp. 233-234)

I posit that the various texts or stories we come in contact with influence our representations of math and how we view our mathematical selves. However, many of these stories do not represent reality but only give us representations that we use to describe reality. For example, according to Ellsworth (1994), “representation refers to the process that individuals and groups

use to interpret and give meaning to their experience, through language, stories, images, music, and other cultural constructions” (p. 100). We must remember that these stories are used to construct people’s values and beliefs and many times these stories are constructed with a particular intent or agenda in mind and contain just enough truth to convince people that they are real events or, as Lyotard claims in *The Postmodern Condition: A Report on Knowledge*, to make these stories legitimate.

I will also consider the many narratives and texts that help to create an anxiety and fear of mathematics. What narratives give a negative perception of mathematics or school in general? What types of texts or narratives create an environment where a negative attitude in mathematics is legitimized and made to seem the norm? I will discuss Peter Taubman’s *Teaching by Numbers* to show the irony in how anti-intellectualism articulated with the mass media are deeply involved in the standards movement and taking over education as we know it in an attempt to dumb down the masses. Therefore, in order to better understand why it is culturally and socially acceptable to be mathematically illiterate and innumerate, I will examine the various texts and statements that function to create our perceptions and attitudes about mathematics that have an impact on the teaching and learning of mathematics. In chapter 6, I will explore teaching math at a time when the very foundations of mathematics are in question. Math is ever changing and very dynamic and hopefully our perceptions and attitudes about math will also change. Throughout this chapter, I will consider many of the notions associated with postmodernism, complexity theory, chaos theory, and non-linear dynamics. How can we change the image of math? By considering fuzzy systems, I hope to introduce a way to change how we view math curriculum and math education in order to create more autonomy and motivate students to learn.

Through theory I will explore the culture of interest from multiple points of view. For

instance, postmodernists believe there are multiple interpretations of reality and that each person interprets reality differently. For example, in a postmodern view “there is no clear window into the inner life of an individual. Any gaze is always filtered through the lenses of language, gender, social class, race and ethnicity” (Denzin & Lincoln, 2003, p. 31). I will consider my previous experiences in the critical examination of various texts in order to gain a better understanding of how and why we view mathematics the way we do in the United States and how these views are associated with the many complex issues previously discussed concerning mathematics and the teaching and learning of mathematics. One of my previous instructors, Dr. Ming Fang He, has taught me the importance of autobiographical inquiry, and how informative such research can be. This type of inquiry is very important in understanding the world and its meaning from various perspectives. Therefore, by considering math curriculum as autobiographical text, I hope to add to the conversation by describing my experiences and perceptions concerning math and math education and the influence they have all had in creating my personal mathematical identity. I will perform a self-analysis of the influences of culture and attempt to show that math as a discipline, families, friends, schools, popular culture, corporations, and the mass media have a profound influence in shaping our beliefs, values, wants, and desires.

What does it mean for Policy?

When it comes to policy, retention and reform have become major issues. Retention is a major issue both in terms of students and teachers. Because without students or teachers there can be no schools. However, the primary concern of many administrators is for students to remain in school, therefore they pressure teachers to keep students moving along the assembly line without any regard for the student’s best interests. This results in students being promoted

without the skills necessary to survive at the next level and we wonder why so many struggle and fail and eventually drop out of school. This sounds like a recipe for disaster. As educators we should do everything in our power to encourage our students to learn and see to it that they gain the necessary knowledge needed to be successful at the next level and beyond. However, to achieve this goal we need good qualified teachers and one of the biggest problems we face is a lack of qualified math teachers. Our negative social and cultural views of mathematics have created an environment where most people have no desire to study math and this results in extremely low numbers of people with the passion and adequate amount of mathematical content knowledge to teach.

There are probably many people with good teaching skills, however, of these, only a very few acquire the content knowledge needed to ensure they would be good math teachers. Most people never learn the mathematical content necessary to function in everyday life, much less to be a teacher. But because of our social and cultural acceptance of mathematical illiteracy and innumeracy, many kids have been convinced that it is perfectly okay for them to lack mathematical ability and therefore never acquire the skills needed. Since so many people lack this ability, mathematics becomes a barrier that restricts the individual and prevents our society from acquiring an adequate number of well-trained teachers to meet our demands. So, what can be done about it? First we should try and understand why math has become such an obstacle and determine what types of reform are needed in order for educators to teach our students the mathematics necessary to survive and make educated informed decisions. Once math is no longer an obstacle, most students should remain in school and the problem of student retention would be solved.

What does it mean for Practice?

I have taught people music theory, heating and air, guitar, electronics, algebra, voice, calculus, auto mechanics, statistics, probability, and physics. I have been teaching something to someone for as far back as I can remember and even if I weren't a teacher in the formal sense, I would still be teaching something. As I reflect on my wide range of teaching experiences, one major theme stands out, desire. Without a person's desire to learn, it is next to impossible to teach them anything. Therefore, what can be done in order to make the learning of mathematics desirable? Current research in curriculum studies and mathematics argues that a change in pedagogy and curriculum is necessary if we hope to change our views of mathematics and create a desire for such knowledge. One of the problems that we face today is the learning of mathematics is closely associated with getting a better job in order to make more money. However, this leads to an environment where people only have extrinsic or external motivation to learn mathematics. For example, many students are motivated to please their parents, avoid negative consequences from parents, please the teacher, avoid negative consequences from the teacher or school, or to obtain a reward for engaging in the proper behavior. As a mathematics teacher, I hope that my students would all have a high level of intrinsic or internal motivation to learn mathematics. However, studies have shown that if a person enjoys an activity without any reward, and then begins to receive a reward for engaging in the activity, the motivation will shift from intrinsic to extrinsic. Once the reward is removed, the individual will no longer engage in the activity for intrinsic value thereby allowing extrinsic motivation to quickly undermine intrinsic motivation. This could explain why some people are good at math while in school but quickly lose interest when they graduate. In addition, in our culture math is seen as a commodity to be bought and consumed and according to Jardine, in *Curriculum in abundance* "once knowledge is understood as a scarce commodity to be consumed, satisfaction of the desire to

consume is not only not *sought*, it is not *desirable*" (2006, p. 5).

Today, most people have such negative attitudes and perceptions of mathematics, in some cases even fear or hate the subject and because of this, they just have no desire to learn. Because of these views, American culture places no value on becoming mathematically literate and numerate and as a result it is extremely difficult for teachers to motivate students to learn mathematics. Therefore, I hope that this research will give us some insight on how we can inspire students to learn ideas or concepts of which they have absolutely no interest. Something needs to be done to insure that we can motivate our students to learn because without good math skills they will suffer. In practice, it could mean empowering students and not restricting or oppressing them. If we can change our social and cultural views of math, maybe then we can introduce our students to the beauty and transformative nature of mathematics, make math relevant to their lives, and motivate more students to study math. In practice it could mean an abundance of certified math teachers. Furthermore, a shortage of students studying mathematics or science is directly proportional to the shortage of qualified teachers in those fields. However, math has a bad reputation in our culture, therefore, educators should work feverishly to change our cultural views of mathematics. Once our students see the value of becoming mathematically literate and numerate, and desire to learn, algebra and any other type of mathematics will no longer be used as gatekeepers.

If I can find some pattern or theme responsible for creating these negative attitudes, it is hoped that I can somehow use this information in a pragmatic way to better inform policy makers, curriculum designers, and teachers on how to build new positive mathematical experiences and tear down the gateway associated with math. By expanding the discourse on the reconceptualization of mathematics, I hope to find ways to change our historically, culturally,

and socially constructed views of mathematics in order to make a positive impact in the classroom and in the teaching and learning of mathematics. I hope that this research will help shine some light on how math has been used as a tool for hegemonic reproduction. Maybe then we can tear down the barriers created by mathematics and empower the oppressed. Not only would this knowledge liberate these students but would liberate all humans because some of these kids could grow up to become teachers, doctors, or scientists who go on to invent numerous things to make life better for the entire planet.

Finally, in chapter 7, I will attempt to envision a different world of/in/with mathematics. What does this world look like? Why is it important? What kinds of things can people do in the field of mathematics? I will envision a different world of/in/with mathematics, a world where we all live in harmony with mathematics and where math is no longer used as a tool for oppression but for liberation. I hope to find ways to change our historically, socially, and culturally constructed attitudes and perceptions in order to tear down the barriers associated with mathematics and create a world where mathematics education and knowledge can be used as a form of empowerment as well as a means to combat inequality and to fight for social justice. A world where all people have the mathematical knowledge and skill necessary to survive and thrive in any environment. A world where math has value and everyone is highly motivated to seek out this knowledge.

Conclusion

In summary, I am doing this dissertation in order to better understand how our perceptions and attitudes about mathematics and mathematics education have been historically, socially, and culturally constructed in the United States and for what end. For example, I find it very suspicious that we live in a society that supposedly values mathematics and mathematical

knowledge, but have so many people who are mathematically illiterate or innumerate. We live in a society where math has no value, but in a world where mathematical knowledge and ability are necessary to survive and function. A society where math is used to dominate and oppress, but in a world where math can be empowering and liberating. I'm addressing these issues because, as a college math teacher, I am concerned about the mathematical illiteracy and innumeracy running rampant in our society and how a lack of this knowledge has become a powerful form of oppression. For instance, I see how our socially and culturally constructed views of mathematics have created an environment where math is associated with intimidation, fear, failure, and hatred and functions as a gatekeeper. My hope is to add something to the discussion about how to tear down the barriers and walls associated with math that have restricted students from reaching their full human potential, and to expose the mathematical hegemony, hidden in plain sight, that percolates throughout our culture.

We need to find a way to change our social and cultural attitudes and perceptions that precipitate and lie embedded in American Culture when it comes to mathematical teaching and learning. If we can do this, we can solve many of the social issues associated with mathematics. For example, according to Tobias (1993) a cure for math anxiety is possible but it will “require changing popular perceptions about mathematics” (p.10). I hope to create new cultural and social attitudes where math illiteracy is not a badge of honor and work to get more people mathematically literate and numerate. We need to create a culture and society that views math in a positive light. Maybe then math will no longer be an obstacle because everybody will have the necessary mathematical knowledge and ability to function in, and transform, society. If this research can help create a culture of learning, a place where it is socially and culturally unacceptable to be mathematically illiterate and innumerate and all students have a desire to

learn, I will consider my inquiry as a form of what Freire (2004) calls praxis; “reflection and action upon the world in order to transform it” (p. 51).

According to Eric Gutstein and Bob Peterson in *Rethinking Mathematics: Teaching social justice by the numbers* (2006), “math has the power to help us understand and potentially change the world” (p. 5). Therefore, I am doing this dissertation in order to better understand how to teach math in ways that empower and motivate students to learn. I seek to find ways to reform mathematics education in order to increase motivation and access to learning so that students can start to see math as a very valuable and needed transformative tool, a tool that can be used to fight against anti-intellectualism, math illiteracy, innumeracy, inequality, and social injustice in our society. I hope to better understand how popular culture and the media have the power to influence education in both positive and negative ways and to bring attention to the very discourses that negatively impact the desire to become mathematically literate and numerate. I am doing this research because according to Appelbaum (1995), “finding ways to understand how such meaning is produced, and how our very categories of perception are constructed or legitimized, is a worthwhile academic task” (p. 11). Without all of us working towards these goals together, we will continue to limit and oppress our next generation of students. We will be guilty of slamming the door on so many of their futures. Therefore, as educators we should do everything we can to prevent these injustices and create a world where math empowers our students to reach their full potential.

There have been many scholars who have written about the influence popular culture has in creating and reproducing ideology, and the way in which resistance plays a role in cultural production. Many scholars have written about mathematical illiteracy and innumeracy, however, I am exploring why it is culturally and socially acceptable to be mathematically illiterate and

innumerate in a society where mathematical ability is a form of empowerment. It just doesn't make sense that math is being used as a gatekeeper to weed out certain groups. According to Gutstein (2006), people need the ability to read the world with mathematics so they can "understand the social political, cultural-historical conditions of one's life, community, society, and world" (p. 4). Once they can read the world with mathematics, they will have the ability to write the world with mathematics, "to effect change in it" (Gutstein, 2006, p. 4).

CHAPTER 2

CURRICULUM STUDIES AND MATHEMATICS

Throughout this research, I hope to gain a better understanding of why we view math the way we do in the United States and how these views have created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate. Could all of the social problems associated with mathematics be a result of these views? Therefore, in this chapter, I will consider the goal of education and the concept of curriculum. I will examine some of the major movements in the history of curriculum and curriculum studies as well as teachers and our current mathematics curricula and pedagogy in an attempt to determine what role, if any, they have played in our historically, culturally, and socially constructed attitudes, perceptions, and norms concerning education and mathematics and the impact these views have on our motivation or desire to learn. I hope to show how the history of curriculum is connected to how we view mathematics today. For instance, mathematics or arithmetic have always been a major part of the traditional curriculum and have evolved into what we consider our current mathematics curriculum. I will investigate our current mathematics curricula and pedagogy to determine if they serve the purpose of mathematics education. I will examine what is currently happening in the field of curriculum studies and mathematics and discuss what many of the current scholars in the field are saying about math, mathematics pedagogy, and curriculum. Along the way, I hope to share my analysis and opinion of the many issues discussed in hopes of adding to the discourse.

What is the goal of education?

What is the goal of education and should it be the same for all students? According to Gutstein (2006), in most of his discussions with parents about education, the parents “main

position was that education should prepare students for life. ...the parents believed education was necessary for their kids to survive” (p. 188). As an educator, I have heard some of these same comments. However, there are many different philosophies and opinions when it comes to the goals of education. For instance, one is to cultivate the mind and develop a person’s intellect. Others such as the instrumentalists believe “that an education ought not to necessarily cultivate the mind but prepare a person for a specific vocation” (Weaver, 2009, p. 7). Many of these vocations require a specific level of mathematical ability. However, Kaustuv Roy in *On the Critical Paradoxes of Cupid and Curriculum* (2005), argues that there are some serious issues with the traditional instrumentalists and utilitarian views of education because of their emphasis on goals and standards that are present and extraneous to the process itself.

Mukhopadhyay, Powell, & Frankenstein in *An Ethnomathematical Perspective on Mathematics Education* (2009) "contend that the central purpose of education is to contribute to the development of our collective world, in the direction of more justice" (p. 77). In *The Dreamkeepers*, Ladson-Billings (1994) posit that education should be about empowerment and liberation. According to Gutstein (2006), education should help develop positive cultural and social identities. For instance, education should help develop people who

are strongly rooted in their home languages, cultures, and communities but at the same time, are able to appropriate what they need to survive and thrive in the dominant culture [and] the self-confidence, perseverance, and courage that are necessary for them [to] act on their sense of social agency. (p. 147)

With so many viewpoints, how do we decide the goals of education? However, a decision needs to be made because “progressives like John Dewey, [have argued] that the goals of education must be considered as immanent to the field” (Roy, 2005, p. 243). In *The way out of educational*

confusion (1931), Dewey argues that the purpose of education should be “to arouse intellectual interests which carry over and onwards [and] awaken some permanent interest and curiosity” (p. 38). However, it is questionable if any of these goals are being achieved.

What is curriculum?

Once we determine the goals of education, we need to determine how we can reach these goals, and this brings us to the concept of curriculum. According to William Doll in *The Culture of Method* (2005), "curriculum originally meant a (circular) racetrack for running ... John Calvin in the mid-1500s appropriated the word for his notion of a course of life (*curriculum vitae*)” (p. 55). The *Oxford American Dictionary* (1980) defines curriculum as: “a course of study.” Many people would tell you that curriculum is the stuff we learned in school. But who decides the curriculum or the course of studies? Who decides what knowledge is of most worth? What curriculum should we teach our students, and should all students learn the same material? Davis in *Teaching Mathematics* (1996) contends that curriculum “is about the business of sifting through what is known and selecting those aspects of our knowledge that are deemed important for the ongoing viability of our society” (p. 84). Therefore, what types of mathematical topics are deemed important for the ongoing viability of our society? In *What is Curriculum Theory?* (2004), William Pinar argues that there are no easy answers because "the concept of curriculum is complicated conversation” (p. 184).

However, because of this complexity, curriculum can be hidden and used to oppress. For example, according to Trueit (2005) a

‘mimetic curriculum,’ [in fact,] produces and reproduces a particular cultural order, replicating simple forms of thought. Educational systems seem dedicated to normed, ordered thinking, ...[and] develop citizens that see a simple order – seldom choosing to

see, but perhaps, incapable of seeing otherwise. (p. 94)

From Trueit's definition, a mimetic curriculum could just as easily been called a hegemonic curriculum. This is why the learning associated with the 'hidden curriculum' is most often treated in a negative way. It is learning that is hidden from the masses and serves the interests of the status quo. However, according to Catherine Cornbleth in *Curriculum in Context* (1990), not all hidden learning is negative and can sometimes be liberating "in so far as they enable students to develop socially valued knowledge and skills[,] ...to form their own peer groups and subcultures, ...contribute to personal and collective autonomy[,] and to ...critique and challenge ...existing norms and institutions" (p. 50).

Brief History of Curriculum

Curriculum in early America was a form of classical or theocentric traditionalism consisting of reading, writing, Latin, Greek, and religious works. People were taught to read for the primary purpose of reading scriptures and the main objective of education was to teach students to be autonomous God-fearing Christian citizens. This type of curriculum never emphasized mathematics instruction pass the basics of arithmetic. The curriculum was very rigid and students had no say in the subjects or topics to be covered. Punishment and humiliation were the primary means of controlling student behavior and motivating students to learn. The historical views from the past are still part of our social and cultural views today. However, as education evolved, the concept of curriculum began to change. For example, with the introduction of Benjamin Franklin's Academy, students were able to determine their own curriculum. Some of the students studied the classical curriculum consisting of Greek and Latin, while others studied languages such as French and German. In addition to reading, writing, and orating, "Franklin's academy would include physical education, drawing, mechanical arts,

mathematics, history, geography, civics, horticulture, science, and religion. ...Instruction would not be exclusively through lectures and recitation, but would include active inquiry into the subjects studied and even field trips” (Willis et al., 1994, p.17). However, these are only two of the many possible views on curriculum.

Major movements in the history of curriculum

Faculty Psychology

Throughout our American history there have been four major movements in curriculum. The first of these movements, faculty psychology, “was the basis for the method of mental discipline in education” (Tanner and Tanner, 1990, p. 38). The concept of mental discipline considered the brain a muscle and posited that if a person exercised certain faculties of the brain then other parts of the brain would also benefit. “The school curriculum based on faculty psychology emphasized the classical subjects and disciplines such as Latin and mathematics” (Pinar et al., 1995, p.74). The curriculum under faculty psychology was very rigid because they believed that only certain subjects and topics could exercise the brain. The methods of instruction consisted of recitation and rote memorization and “the aim of education was to expand the powers of the mind and to store it with knowledge” (Pinar et al., 1995, p.74). It is here that we see where mathematical pedagogy became associated with recitation, rote memorization, and drill and practice which are still very prevalent today. Growing out of faculty psychology is the next major movement in the history of curriculum, the humanist movement.

Humanist Movement

Many in the humanist movement embraced the concept of mental discipline and believed in the development of intellect through traditional subjects. Two of the major players in the humanist movement were Charles Eliot and William Torrey Harris. Eliot suggested “the right

selection of subjects along with the right way of teaching them could develop citizens of all classes endowed in accordance with the humanist ideal – with the power of reason, sensitivity to beauty, and high moral character” (Kliebard, 1995, p.10). A humanist approach could help us see the beauty in mathematics. Harris discusses his curriculum theory in *Psychological Foundations of Education* (1898) where he described the “five windows of the soul [which] consisted of arithmetic, geography, history, grammar, and literature [and] strongly endorsed the 'textbook-recitation approach' [in which] the textbook was both the instructional method and the curriculum” (Pinar et al., 1995, p. 76).

Following in the humanist tradition, perennialists also called classical humanists and essentialists, also embraced the concept of mental discipline and believed that certain subjects must be studied in order to become intelligent. All of these groups

never gave any consideration to reform, the interest and needs of the learner, or the treatment of contemporary problems in the curriculum, on the ground that such concerns are temporal and only detract from the schools mission of cultivating the mind. (Tanner & Tanner, 1995, p.152)

This has evolved today into students feeling that mathematics is not relevant to their life or interests. However, the study of education psychology has presented considerable evidence to refute the concept of mental discipline. For instance, Thorndike and Woodworth published a study in the *Psychological Review* (1901) that showed an improvement in one mental function did not necessarily cause another mental function to improve, and in *The Principles of Teaching*, Thorndike (1906) suggested that people learn new knowledge and skills best when they are related to previous knowledge and skills, and that learning and the development of the intellect would occur without the study of the classics. Many of the ideas and concepts brought to light by

educational psychology helped to influence the next major movement in our history of curriculum, the progressive movement.

Progressive Movement

The progressive movement started with the Herbartians who thought the purpose of school was moral development and that certain subjects were better than others at developing moral character. Although Herbartianism never quite got off the ground, it did help “to undermine classical curriculum theory and mental discipline (i.e. faculty psychology), [and] functioned as a transitional theory” towards a child-centered theory of education and leading the way for the progressive education movement (Pinar et al., 1995, p. 83). Two key figures of the progressive movement were Colonel Francis W. Parker and G. Stanley Hall. Parker, considered by many the father of the progressive movement, “shared the Herbartians’ opposition to the classical curriculum” (Pinar et al., 1995, p.86). According to Sadovnik & Semel (2002), “Parker’s philosophy and practices focused on developing a complete person as well as responsible citizens” (p. 126). Hall believed in the cultural epochs theory and argued “that a curriculum organized in this way had a guaranteed appeal to children’s interests” (Kliebard, 1995, p. 39). Hall understood the importance of motivation and desire when it comes to learning, and theorized that depending on a person’s age and level of development certain subjects had a greater appeal than others. Hall’s views help us to understand that people need to reach a certain level of development before they are ready to study selected topics in mathematics. Keeping with the Herbartian view that the purpose of school was moral development, Hall argued “that the purpose of literature in the high school” was to have students read some of the great legends that instilled positive moral values (Kliebard, 1995, p. 41).

The next major player in the progressive movement, John Dewey, believed that the

school curriculum should be reconstructed to address the dynamic nature of knowledge and the ideas of democracy and was very critical of the “routinization, memorization, and recitation [that] characterized the classical curriculum for mental discipline [and] insisted that the child’s experience must form the basis of the curriculum” (Pinar et al., 1995, p.105). Progressive educators felt that the curriculum was irrelevant if the knowledge was never learned by the student and therefore argued that education should be linked to the experiences, knowledge, and social issues of life. In *Child and the Curriculum* (1902), Dewey argues that in order to increase a person’s interest, desire, and motivation to learn we must link the teaching of subjects or topics to past experiences. Here we can see the influence of Thorndike’s findings on Dewey’s view of education.

Dewey knew that in order to increase learning and motivation he needed to link the teaching of subjects to the past experiences of students. In *Experience and Education*, Dewey claimed that the problem with traditional education was that teachers took for granted the purpose of the child and in doing so, failed to underestimate the child's motivation or interest in the subjects being taught. As I reflect on my experiences in middle school and high school, I can remember all of the subjects of interest and how highly motivated I was to obtain this knowledge. However, in the subjects for which I had zero interest, I usually did very poorly, not because the material was difficult but because without a desire or motivation to learn the information I did not spend the time needed to learn. That is probably why many in the progressive movement believe that curriculum is irrelevant if the knowledge is never learned by the student. What we learn from Dewey is that in order to successfully teach mathematics we must first link the new mathematics with previous knowledge. The problem is that today most students never have past experiences to build on.

Social efficiency movement

When the concern about waste in schools became articulated with the theories of experimental psychology, the social efficiency movement was born. For example, the social efficiency movement believed that there was too much waste in the schools and wanted to make the schools more efficient. This waste was not only in the resources of the schools but came from teaching students subjects "they will never use" (Kliebard, 1995, p. 85). "One of the main missions that social efficiency reformers set for themselves was that of replacing what was useless and merely symbolic in the curriculum with what was useful" (Kliebard, 1995, p. 102). Frederick Winslow Taylor, a key contributor to the social efficiency movement, famous for his scientific management of factories, believed that "instruction of the subjects should be broken down into small increments and placed in sequence" (Pinar et al., 1995, p. 95). In other words, every task needed to be broken down into its elementary components and carefully investigated to eliminate waste. It is here that we see why people today feel that mathematics is a series of small topics placed in sequence which many times has no relevance to a student's life. The question remained as to how to determine if we were reaching our educational goals and the effectiveness of teaching and learning?

However, this historic period saw the rise of behaviorism in education ushered in by Edward Thorndike's scientific study of learning, Russian physiologist Ivan Pavlov's classical conditioning studies, and B.F. Skinner's operate conditioning. They all were looking for changes in behavior that could be easily observed and objectively measured. After the introduction of Thorndike's *An introduction to the Theory of Mental and Social Measurement* in 1904, the use of empirical methods became increasingly used to develop curriculum and "lead to a mathematical scientific basis for determining the effectiveness of teaching and learning" (Pinar et al., 1995, p.

92). Thus we see the birth of the standards movement consisting of evaluation by testing. All of these movements have been very influential in the construction of our historical, cultural, and social views concerning education and mathematics and have had a serious impact on our desire and motivation to learn.

What is curriculum studies?

In *Crisis, Reconceptualization, Internationalization* Pinar posits that contemporary U.S. curriculum theory is structured by three historical moments, and Franklin Bobbitt's *The Curriculum* published in 1918 starts the first of these three historical moments. Bobbitt, a major player in the social efficiency movement, felt that curriculum should prepare students for adult life and help them meet their social needs (Pinar et al., 1995, p. 97). Bobbitt believed that we should construct the curriculum based on the knowledge necessary to survive and thrive in the world. In 1949, we saw the publication of Ralph Tyler's *Basic Principles of Curriculum and Instruction*. Tyler considered 30 years of what he called "the scientific study of curriculum" (p. 4) in developing his rationale. In the beginning of the book, Tyler asks the reader to just consider some of his thoughts. He never knew his small book would become the foundation of curriculum for years and years. Tyler called for students to learn a set of objectives and for teachers to find experiences to accomplish these goals as well as evaluate if the students had learned the objectives. Tyler wanted schools to attend to the needs and interest of the children, as well as teach subjects that would be useful to all citizens. He felt that evaluation was important to determine if any learning had taken place; however, did not feel that standardized tests were the only form of evaluation.

After the publication of Tyler's *Rationale*, curriculum scholarship was still mostly about curriculum development but with a new emphasis on evaluation. For example, what types of

curriculum worked best at changing behavior, and what methods of evaluation could be used to best measure this change? To determine if a change in behavior had taken place or that a person had actually learned to some measurable degree what was intended became the foundation of evaluation. The problem is, when it comes to learning, is it possible to create an objective evaluation method that measures the infinite amount of knowledge that a person may obtain in a particular learning situation? I seriously doubt it. However in keeping with the scientific study of learning, the method of evaluation mostly employed objective quantitative methods to produce an empirical product, the grade.

Overcome by the influence of positivism, behaviorism, and structuralism, curriculum scholarship focused mainly on curriculum development and evaluation and moved deeper and deeper into empirical methods. However, traditional methods, somewhat limited in scope, painted only a partial picture of reality and failed to answer many questions of interest in the field. This prompted, Schwab (1970) to suggest that the field "is unable, by its present methods and principles, to continue and contribute to the advancement of education" (p.1). Up until this time, traditional curriculum studies had controlled most of the scholarship; however, their research was mainly on curriculum development. However, by questioning the basic assumptions of the traditional field and deciding to push the boundaries of traditional methods, curriculum scholarship moved from a preoccupation with curriculum development, back in the direction of the humanist tradition concerned with the personal growth of the students and "with those characteristics that are thought to make us most human" (Davis, 1996, p.179) by understanding curriculum. For example, "the field would shift from a primary and practical interest in the *development* of curriculum to a theoretical and practical interest in *understanding* curriculum." (Pinar, Reynolds, Slattery, & Taubman, 1995, p. 187). This shift in the field

resulted in what Pinar in *Crisis, Reconceptualization, Internationalization* (2007), calls the second major movement in U.S. curriculum theory, the reconceptualization.

Pinar (2007) gives most of the credit for the reconceptualization to Dwayne Huebner. For instance, he posits that “the work of James B. Macdonald (1995) and Maxine Greene (1971) was influential” in creating the theoretical groundwork of the reconceptualization, however, “that of Dwayne Huebner (1999) was decisive.” According to Short (1991), Dwayne Huebner’s 1963 paper entitled *Notes Toward a Framework for Curriculum Inquiry* was a major influence in expanding the range of inquiry in the field of curriculum studies (p. 328). In *Curriculum as a field of study* (1966), Huebner discussed the concept of curriculum as a field and ushered in multiple forms of curriculum inquiry such as curriculum as political, phenomenological, aesthetical, and theological text. All of these forms of inquiry are very important when we consider any mathematics curriculum.

Although Dwayne Huebner and James MacDonald were very influential in expanding curriculum inquiry to include a variety of different forms (Pinar et al., 1995, p. 212; Short, 1991, p. 329; Schubert et al., 2002, p. 195), others have also made significant contributions to the field by introducing and using a multitude of methods and forms. For example, according to Schubert et al. (2002),

Schwab, Pinar, Reid, Apple, Greene and many of the others who utilized alternative orientations to curriculum inquiry helped to set precedents for alternatives to conventional curriculum writing. They helped to create interest in a hybrid mix of traditional experientialism and critical reconstructionist emphasis on moral purpose as well as social, political, and economic justice. (p. 194)

Although the traditionalists battled very hard for the status quo, the concepts and ideas of

understanding curriculum brought to light by the reconceptualists opened the eyes of many scholars in the field and they never let it go.

By "the early 1990's, it is clear that the American curriculum field was reconceptualized swiftly and rather completely" (Pinar, Reynolds, Slattery, & Taubman, 1995, p. 238). For example, Hlebowitsh (1997) posits that although the field of curriculum was once stuck in the procedural interplay between behaviouristic objectives and instructional judgments [is now supportive of] hermeneutics, feminist theory, psychoanalytic inquiry, deconstructionism, and a wide range of postmodern and post-critical concerns. Some scholars have been impressed enough with this new display of diversity to announce that the US field has undergone a fundamental reconceptualization.

The reconceptualization help introduce us to a new era of curriculum scholarship called *curriculum studies* that seeks to gain a better understanding of curriculum as historical, political, institutional, racial, gendered, phenomenological, hermeneutical, postmodern, and poststructural texts. Although there are many different types of inquiry than those previously listed, I will discuss only a few of them. For example, in this chapter, I will briefly discuss some of the types of inquiry applicable to this study and explore other types of inquiry consistent with curriculum studies.

Curriculum studies seeks to gain a better understanding of curriculum as historical texts by considering the history of curriculum. Two prime examples of curriculum as historical texts are Kliebard's, *The struggle for the American curriculum 1893-1958*, and Watkins' *The white architects of black education: Ideology and power in America, 1865-1954*. For example, Kliebard takes us on a historical journey through the many reforms, movements, and shifts in the field of curriculum. This text plays a vital role in understanding the historical development of

American curriculum from 1893 to 1958. Watkins does a historical investigation of black education, or the lack thereof. His investigation discusses the history of black education after slavery and how science, the eugenics movement, and many of the wealthy white philanthropists influenced and shaped black education.

As discussed in chapter 1, everything in life is political. When considering mathematics curriculum as political text, we can gain some insight into the concept of power and how power is associated with domination, reproduction of the dominant culture, resistance, and hegemony. People such as Paulo Freire and Antonio Gramsci helped us in understanding curriculum politically or as political text and were very influential in shaping many of the notions of the 1970s. In Freire's text *Pedagogy of the Oppressed* (1970), he discusses the political nature of education and how being neutral means you are on the side of the dominant culture. For Freire, education is used as a means for domination, and therefore literacy as well as mathematical literacy are important components necessary to liberate people oppressed by the rigid structure of society. His liberation pedagogy called for society to be restructured to allow those who are oppressed to become liberated and empowered and argued against the "banking concept of education" and how it was commonly used to subjugate members of society. He felt that dialogue is a major component in breaking down the rigid structure of the banking system and warns us about how once liberated the oppressed may soon become the oppressor. In *Selections from the Prison Notebooks* (1971), Antonio Gramsci discusses the politics of education and how education is another tool of hegemony used to maintain state and civil society. Gramsci argued that hegemony was a means for the dominant power to maintain the status quo. According to McNeil (1996), both Freire and Gramsci believed that "the function of the curriculum was to provide each learner with intrinsically rewarding experiences that contribute to personal

liberation and development” (p. 6). Nevertheless, today we are faced with a type of mathematical hegemony that functions to reproduce the status quo.

By considering curriculum as institutional text, we can gain a better understanding of how and why many of our social and cultural institutions such as schools and teachers, the family, peers and peer culture, the media, and major corporations shape and reproduce dominant ideology or culture. Scholars such as Henry Giroux and Michael Apple have been very influential in helping us to understand curriculum as political and institutional text. Their correspondence theory says that institutional propaganda reproduces the economic and political order of society, and that institutions such as schools work to reproduce the dominant ideology (Apple, 1979, 2004; Giroux, 1981, 1983). In *Breaking in to the movies: Film and the culture of politics* (2002), Giroux talks about the power of the mass media in the reproduction of the dominant ideology and culture and argues that people need to know

how power works within cultural apparatuses, and a keener sense of how the existing generation of youth are being produced within a society in which mass media plays a decisive if not unparalleled role in constructing multiple and diverse social identities. (p. 57)

Identities many of which help to reproduce the masses and maintain the status quo.

We saw curriculum as racial text with the help of authors like McCarthy, Kozol, and Delpit. In *The uses of culture* McCarthy (1998) discusses racial differences and how others of different races and ethnicities are viewed in terms of stereotypes. She discusses how the desegregation in the schools actually did more to harm the chance of black children to succeed instead of helping them and how multiculturalism that seeks to avoid the othering of individuals from different backgrounds is the biggest challenge in postmodern times. Jonathon Kozol

considers curriculum as racial text by exposing the differences in educational opportunities and facilities for white and minority students in the same area and nationwide. In *Death at an early age* (1967), he describes the abuse and humiliation of black children in the Boston public school system and exposes the decrepit conditions of the school facility. In *Savage Inequality* (1991) and *The Shame of the Nation* (2005), he illustrates the disparities of funding of education between whites and minorities and argues that many schools in urban areas like New York and Chicago are essentially segregated to this day. Michael Apple in *Educating the "Right" way: Markets, standards, God and inequality* (2001) also considers the influence of curriculum as racial texts discusses how current educational policies cater to middle and upper-class whites.

Lisa Delpit in *Other people's children* (1995) heightens our awareness of teaching in diverse schools and provides the opportunity to reassess the way we view poor children and children of color by getting us to realize how learning between white teachers and minority children is a two way street. In *The real Ebonics debate: power, language, and the education of African-American children* (1998) she argues that one cannot be for or against Ebonics. It exists. It is the language many African-American children hear ... It is the language they encounter. Educators need to recognize that they do not have an accurate understanding of the way many children of African heritage speak. In *The skin that we speak: thoughts on language and culture in the classroom* (2002), she discusses the relationships between language, race, identity, and school success and focuses on the problems faced by African-American students from pre-K to high school. She attempts to answer questions about the use of Standard English versus language from home and discusses our negative or hostile attitudes about Ebonics and what can be done to change these attitudes.

Curriculum studies considers curriculum as phenomenological text by exploring the

structures of consciousness as experienced from the first person perspective. The purpose of phenomenology is to focus and describe unique characteristics of one or more individual's experiences of a phenomenon. For example, phenomenology could help me describe my experience as a teacher or my experience in performing. The researcher seeks to obtain a view into the research participant's world in order to gain a better understanding of how their personal meanings are constructed from their lived experiences. According to Denzin and Lincoln (2003) "phenomenological analysis is principally concerned with understanding how the everyday intersubjective world (the life world, or *Lebenswelt*) is constituted. The aim is to grasp how we come to interpret our own and others' action as meaningful" (p. 297). If we consider more than one individual, researchers seek to find common or consistent themes across the research participants.

In van Manen's text *Researching lived experience: Human science for a action-sensitive pedagogy* (1990), he suggests that

when we raise questions, gather data, describe a phenomenon, and construct textual interpretations, we do so as researchers who stand in the world in a pedagogic way...pedagogy requires a phenomenological sensitivity to lived experience...a hermeneutic ability to make interpretive sense of the phenomena of the lifeworld....[and]...play with language in order to allow the research process of textual reflection to contribute to one's pedagogical thoughtfulness and tact. (1990, pp. 1-2)

For van Manen, phenomenological research includes

the study of lived experience, ...the explication of phenomena as they present themselves to consciousness, ...the study of essences, ...the description of the experiential meanings we live as we live them, ...the human scientific study of phenomena, ...the attentive

practice of thoughtfulness, ... [and] a search for what it means to be human. (1990, pp. 8-13)

Phenomenology is important to curriculum studies in terms of scholarship and because of its association with various other philosophical movements in the field such as existentialism, poststructuralism, and postmodernism.

When considering curriculum as a hermeneutical text, we gain insight into the art of interpretation and understanding. According to Denzin and Lincoln, “hermeneutics argues that understanding is not, ... a procedure – or rule – governed undertaking; rather, it is a very condition of being human. Understanding *is* interpretation” (2003, p. 301). As a theory of interpretation, hermeneutical inquiry can help us make sense of an experience in terms of both linguistic and nonlinguistic expressions. As a means of better understanding what other people may experience by putting ourselves in the other person’s shoes, van Manen (1990), helped expand phenomenological inquiry by introducing us to hermeneutic phenomenology. This type of inquiry can help us to better understand how people feel when confronted with mathematical situations. He suggests that one the most important components vital to interpretation and central to the process of hermeneutic phenomenological research is writing. For example, according to van Manen, when we carry out a hermeneutic phenomenological study, “writing is our method” (1990, p. 124). “Writing”, he suggests: “separates us from what we know and yet it unites us more closely with what we know. ...distances us from the lifeworld, yet it also draws us more closely to the lifeworld” (1990, pp. 127-128).

An influential and very important scholar in his own right is one of Pinar’s former students, William Reynolds. Reynolds has contributed to the understanding of curriculum as a hermeneutical text (1989), as well as phenomenological and poststructural text (2003) and

encourages us to seek new “lines of flight” (Reynolds, & Webber, 2004) when thinking about curriculum. According to Schubert et al. (2002), “William Reynold’s work, in addition to his second authorship on *Understanding Curriculum*, has contributed to the understanding of curriculum as a hermeneutic, phenomenological, and deconstructed text” (p. 511). According to Schubert et al. (2002), “books by William Pinar (1974, 1975), Macdonald and Zaret (1975), and Maxine Greene (1978) [also] provided phenomenological and existential perspectives on purposes of both educational activity and research” (p. 210).

When considering curriculum as aesthetic text, we gain a better understanding of the importance of the arts in education. For example, according to Greene (2001),

‘aesthetics’ is a term used to single out a particular field of philosophy, one concerned about perception, sensation, imagination, and how they relate to knowing, understanding, and feeling about the world. For some, ‘aesthetics’ has primarily to do with the kinds of experiences associated with reflective and conscious encounters with the arts. Or it may focus on the way in which a work of art can become an object of experience and the effect it then has in altering perspectives on nature, human beings, and moment to moment existence. (p. 5)

Eisner (2004) suggested there are many things education can learn from the arts. For example, the arts can teach us “that there can be more than one answer to a question and more than one solution to a problem; variability of outcome is okay” (p.196), “the importance of imagination” (p. 198), or “that intrinsic satisfaction matters” (p. 202). Sometimes the satisfaction that comes from the arts or participating in the arts becomes a means of escape thereby taking us on a journey devoid of time and space. Aesthetic education helps expand our senses and helps us to see the world in new and unimaginable ways and be in the world in new and unimaginable ways.

Both Greene's and Eisner's works are very influential in convincing us of the importance of the arts in education. By considering mathematics curriculum as aesthetic text, we can teach students both the practical applications of mathematics as well as the beauty of mathematics.

According to Pinar (2007), the third major movement in U.S. curriculum theory is postmodernism. Postmodernism assumes that all knowledge, concepts, or ideas are socially and culturally constructed and made legitimate through the use of narratives. Postmodernism embraces subjectivity and the multiple interpretations of reality, considers universal truth impossible, and believes people tell stories to explain the world. Postmodernism argues that all knowledge, claims, or statements can be deconstructed and that there are many ways of knowing and no single way is superior to any other. Curriculum as Postmodern, Poststructural, and deconstructed text introduced us to authors like Jacques Derrida (2002) and his deconstruction, Jean-Francois Lyotard (1984) and his metanarratives, and Cleo Cherryholmes (1988) and his critical pragmatism. Other curriculum scholars such as Michel Foucault (1970, 1995), Jean Baudrillard (1970, 1981, 1983), William Doll (1993), Henry Giroux (1981), Peter McLaren (1999), Peter Appelbaum (1995), Martusewicz (2001), and John Weaver, Peter Appelbaum, and Marla Morris (2001) have also been very influential in the advancement in our understanding of curriculum as Postmodern, Poststructural, and deconstructed text. Today postmodernism has introduced us to many different new types of mathematics discussed later in this study.

Although the reconceptualization did expand the scope of curriculum inquiry and move us into the age of curriculum studies, the work of curriculum studies scholars is not over because the Tyler Rationale is still a mainstay in many schools. On the bright side, current scholarship in *curriculum studies and mathematics* consists of many different theoretical orientations and although we can still feel the power of the traditional notions of mathematics pedagogy and

curricula, much of the current theory is a direct result of the reconceptualization.

What is the current mathematics curricula and pedagogy?

So what is the current mathematics curricula and pedagogy and what role, if any, do they play in shaping our socially and culturally constructed views of mathematics. How are these views associated with our motivation and desire to learn math? Does our current mathematics curriculum and pedagogy serve the purpose of mathematics education? According to Davis (1996), “with emerging insights on the evolving nature, the implicit prejudices, and the cultural status of mathematics (not to mention the changing needs of society), the question has been taken up with renewed vigor by curriculum theorists” (p. 84). Although pedagogy may vary, our current curricula in elementary and secondary schools consist of topics from arithmetic, algebra, trigonometry, geometry, calculus, and statistics. Therefore, let us begin by considering the two most common methods of instruction as discussed by Grundy in *Curriculum* (1987) and Davis, Hauk, & Latiolais in *Culturally Responsive College Level Mathematics* (2009), the transmission and product models.

Transmission model

In the transmission model, also coined the “banking model” by Freire (1970), the instructor has the job of transmitting pre-selected information to students mostly through lecture (p. 75). The “curriculum is the content of the syllabus and textbook. Students are vessels to receive this content and they are responsible for structuring it for their own future use as thinkers” (Davis, Hauk, & Latiolais, 2009, p. 349). However, many times the students structure this content through rote memorization of signs, symbols, and rules in which they have no understanding. “Students and teachers are guided by the demands and constraints of academe (classical forces)” (Davis, Hauk, & Latiolais, 2009, p. 350). Therefore it is easy to see that the

body of knowledge transmitted, typically amounts to a series of unconnected pre-specified topics learned through rote memorization and drill and practice that have little or no relevance in the lives of students!

Although there are major problems with this method, it is one of the primary methods of instruction used in middle school, high school, and college. For instance, as an educator, I have witnessed how under the transmission model, students are passive and quickly lose interest resulting in them either sleeping or texting and not actively participating in learning. According to Wang in *Chinese Aesthetics, Fractals, and the Tao of Curriculum* (2005),

the traditional linear way of teaching and its transmissional mode passes knowledge from instructor to student without problematizing the issue at hand in the first place [and] produces students who do not know how to question, explore, and above all, enjoy the journey of learning. (p. 305)

However, all students should learn how to question, explore, and investigate their world.

Learning should be fun, because if students don't enjoy the journey of learning, how can we expect them to have a desire to learn?

Product model

Under the product model, a direct result of Franklin Bobbitt's *The Curriculum* (1918) and Tyler's *Rationale* (1949), curriculum is a prepackaged set of topics broken down into small pieces or units in order to effectively measure if the goals and objectives of producing a product, the educated citizen, have been achieved. The teacher's job is to create activities in which the students participate in order to achieve the set goals and objectives. For instance, according to Davis, Hauk, & Latiolais, under the product model, "students are the raw material to be shaped by instruction [into] the educated worker. ...students and teachers are guided by the demands and

constraints of a capital economy (societal forces) [with] instruction and assessment [following] the assembly-line model” (2009, pp. 350-351).

Once again we see the influence of the factory models of education attempting to run as many students through the factory as possible assessing them through standardized tests with no concern for the education that the students are receiving. In addition to many of the problems associated with transmission model, under the product model, teachers are forced to come up with new and innovative ways to keep tasks interesting because "a steady diet of routine and predictable lessons followed by routine and predictable assignments soon becomes the daily grind" (Brophy, 1986, p. 34). Once a person becomes bored or loses interest it is very difficult to teach them anything. According to Wink (2002), one of the major problems with the transmission and product models is “the teacher-directed lesson too often lacks opportunities for students to interact with one another and with the ideas they are studying” (p. 73).

Teacher or Pedagogy?

Since pedagogy is considered the art of teaching, I feel that any discussion of pedagogy should also include a discussion about the role that teachers play in constructing our attitudes and perceptions of mathematics. For instance, what is the difference between a good mathematics teacher and a bad one? Is it personality or pedagogy? Why are some teachers successful using a transmission or product model, while others are not? Is it the curriculum or the teacher that makes the difference? According to Morris in *Jewish Intellectuals and the University* (2006), “teachers do make a difference! Teachers impact our youth in profound ways. Teachers shape the future of the country. Teachers shape our children. Teachers inspire youth” (p. 7). Teachers play a very influential role in our historically, socially, and culturally constructed attitudes and perceptions of math that seriously impact student motivation and desire to learn mathematics in

both positive and negative ways.

Although some teachers do make a difference, many teachers get blamed for the problems in education and most of the problems in society. For example, Pinar (2004) posits, politicians are blaming teachers for many of the problems in society created by popular culture, the media, or alas the politicians themselves. Taubman in *Teaching by numbers* (2009), suggests "we will all continue to follow the steady stream of newspaper and magazine stories traducing teachers for undermining our economy or failing to keep black and Latino kids out of jail" (p. 15). However, it is hard to deny that many of our attitudes and perceptions of mathematics have been both positively and negatively constructed from previous experiences with teachers.

For instance, each semester I ask my students to give a short presentation about their best and worst math experiences, and why, and although the replies differ, two of the most common themes associated with these experiences had to do with teachers and grades. The best teachers were described as caring and compassionate, upbeat and enthusiastic about mathematics with the ability to inspire, encourage, and motivate. I would hope that all teachers are upbeat and enthusiastic about the subjects they teach because many students feed off of their teacher's energy and enthusiasm for a subject. However, Ernest warns in *New philosophy of mathematics* (2009) that enthusiasm may not be enough because "the teacher may be very enthusiastic and intend for students to develop positive attitudes about mathematics, but the unintended outcome of various factors such as pressure to cover the syllabus for examinations might result in less positive attitudes being acquired" (p. 50). However, if a teacher lacks enthusiasm, you can guarantee that it will rub off on their students and this can have a profound effect on the motivation to learn. A good teacher needs the ability to motivate and inspire their students to learn. Knowing the importance of a positive self-esteem, these teachers help their students to

acquire competence and confidence in their ability to learn and be successful. Therefore, many of their students are able to have successful experiences in math and because of this have constructed a positive outlook on mathematics that can last a lifetime.

A good teacher needs a reasonable amount of content knowledge. According to Paulos (2001), "the background in math of prospective elementary school teachers is ... in many cases, nonexistent ... [and blames elementary] teachers who aren't sufficiently capable, and who too often have little interest in or appreciation of mathematics" (p. 102) for not preparing their students. According to Davis in *Teaching mathematics* (1996),

one of the greatest weaknesses of current mathematics pedagogy is that teachers, in general, have not been adequately engaged in mathematical inquiry in their own educations... Unlike virtually every other area of activity and study – music, athletics, literature, etc. – it is difficult to identify another where a teacher could successfully fulfill his or her responsibilities with such a desolate history of participating in the subject matter. (p. 117)

Davis goes on to say that

a person whose only one page ahead of the learners is not likely to do much more than fixate on the image and ignore the substance, in effect, to rob learners of the very reason the subject is worthy of study in the first place. (1996, p.162)

For example, how could a person teach something that they don't know?

Without this knowledge, a teacher could be responsible for teaching students the wrong information and from my experience, if students are taught incorrectly the first time, it is very difficult for them to learn it correctly. For example, "it is much harder to unlearn an incorrect categorization than to learn it correctly in the first place" (2005, St. Julien, p.113). Because of

these teachers, most students never learn the needed information to move up to more advanced classes. However, I agree with Gay (2009) that it takes more than just content knowledge because teachers also need pedagogical and social skills. For example, according to Gay in *Preparing Culturally Responsive Mathematics Teachers* (2009), “teaching is much more than conveying knowledge to students. ...Teachers must know students as well as content, in order to determine how best to effectively convey the knowledge and skills to be learned” (p. 192). In contrast, I have had teachers who were highly knowledgeable in their disciplines however, they lacked the pedagogical skills or ability to engage or inspire their students. I can still remember those teachers who inspired me the most. However, I can still remember the teachers who would constantly lecture using a voice so monotone that even the most hyperactive person would be lulled to sleep.

In the February 7, 2006 Metro Edition of the Star Tribune an article about why kids hate math quotes a mathematics expert and founder of Mathnasium learning centers named Larry Martinek of Los Angeles as saying “people shudder when they hear the word math because the math they learned in their early years did not prepare them for doing math.” From my experience in mathematics education, I would have to say that negative attitudes are created in the early years because most teachers do not lay the proper foundation in kindergarten and elementary school. The problem is that many students develop their mathematical identities early and if they fail to get the basic foundation in elementary school, many will continue to lag behind. In addition, as previously discussed they have no previous knowledge or experiences to associate with learning more advanced mathematics. Martinek says that when you hear people claim that they hate math, “It's not the math they hate - it's being humiliated when they can't do it.” Martinek, puts some of the blame for Americans' underperformance on the way students rely on

rote memorization rather than learning how to do math. His philosophy is that those things that are memorized are soon forgotten, while things that are learned are never forgotten. That's especially true of doing math, he says.

One of the most common themes associated with the worst math experiences had to do with teachers who did not understand the content and did not care if the students learned the material or not. Here we see the importance of at least creating the perception of having an adequate amount of content knowledge and compassion for students. Some students felt that their teachers totally despised math and teaching in general and this influenced their perception of the subject. For example, in a June 7, 2006 Final Edition of The Post and Courier of Charleston, SC, Principal Bonnie Dill stated that her hatred of math may have caused her to create that same attitude in her students. "Teachers do not have to be directly biased in conveying these beliefs; they are too often so subtle as to be unconscious or unintentional" (Gay, 2009, p. 200). Many of our students are not stupid and notice these kinds of attitudes coming from their teachers even if the meanings are implied and not verbally communicated. Therefore, entry level teachers without adequate math knowledge and skill may pass their shortcomings on to their students. Under these teachers, the students face constant failure and never learn anything and this has a very negative impact on student attitudes and achievement in math because "when the total setting in which teaching and learning occur is negative there is little wonder why students have a difficult time reaching high levels of academic achievement" (Gay, 2009, p. 200).

Teachers must be aware of the influence and impact they can have on how their students will view mathematics. I have heard some teachers say to their students that "today we should learn some mathematics, however, since I don't really like or care for the subject we will do

something else. For example, many people can recall a teacher who hated math and even sometimes influenced their students to do the same. When I ask my students about their first negative experiences with math in the classroom, it is funny that many people can still recall the exact time, place, and person involved and the impact these experiences had in formulating their mathematical identities. Teachers play a very important role in the construction and reinforcement of these views and are partly responsible for the lack of positive mathematical experiences in the classroom. For example, according to Jackson and Leffingwell (1999) only about 7% of Americans have had positive experiences with mathematics from kindergarten through college. The lack of positive experiences in math is why according to Burns (1998) two thirds of U.S. adults, fear, loathe, and hate math. However, a person's reinforcement history based on previous experiences usually determines their views and attitudes towards mathematics.

Although teachers can play a role in creating both positive and negative experiences in math, grades also play a role. For example, when my students present their best and worst math experiences, many times the experience is rated by the grade they receive in the class and not the influence of the teacher. For instance, if the student made a good grade in the class, then they considered the experience a positive one. In contrast, if a student struggled and failed or barely scraped by, the experience was a negative one. Since most students do poorly in mathematics classes, it is easy to see why so many people view the learning of math as some type of torture. Therefore, as teachers we should strive to become positive role models and do everything possible to change our cultural views and prevent these scenarios from happening by make sure our students are constructing positive mathematical experiences and acquiring the knowledge necessary to survive and thrive.

Currently in the field of Curriculum Studies and Mathematics

Although "early in the 20th century, it was productive to imagine education along the lines of an industrial assembly line, where tasks were portioned out, outcomes could be easily measured, and troubles could be easily identified and fixed," (Jardine, Friesen, and Clifford, 2006, p. 6) this view of education is no longer productive. For instance, our current views of education have reached the point of "counter-productivity" (Ilich & Cayley, 1992, p. 11). Just because something may have worked at one time does not mean that it still serves its purpose today and may even exacerbate the problems it was meant to address. Just because the traditional methods and curriculum may have worked in the past, does not necessarily mean they will work today. Therefore, many of the current scholars in the field of curriculum studies and mathematics argue for reform, and are working diligently to advance many of the theoretical frameworks formulated as a result of the reconceptualization. Hopefully their scholarship can help us to solve the many social issues associated with mathematics education and make an impact in terms of practice and policy.

Some scholars argue for reforming and changing our current curriculum and pedagogy because under our current system, mathematics is no longer relevant to lives of most students. For example, in studies of how students perceive mathematics, researchers found "that many students perceive mathematics as not having and being relevant to their lives" (Gutstein, 2006, p. 30). Most people have been conditioned to see mathematical knowledge and ability as something that is unattainable and has little or no practical value for the average person and because of these views, students lack the motivation and desire to learn math and for them math becomes associated with an economic and social gateway. Some scholars argue for teaching mathematics for social justice and others consider the impact of culture on mathematics education. While some scholars question the very nature of mathematics as a discipline, others argue for reforming

standardized testing, because these tests function to restrict access to higher education or better jobs, perpetuate stereotypes, and in most cases, the scores on these tests follow and label a person for life functioning as a means to discriminate, control, and oppress.

Reform current Mathematics Curriculum and Pedagogy

Make curriculum relevant to students

One of the current debates in curriculum studies and mathematics is about how we can reform our mathematics curriculum to make it more relevant to the lives of our students. For example, school mathematics “has come to be regarded as having little to do with the 'real world' and as bearing an even more tenuous relationship to the lived experience of the learners” (Davis, 1996, p. 88). If students perceive a task to be irrelevant, they may have no desire or motivation for engaging in the task. However, our current curriculum according to Davis (1996), “amounts to preselected or pre-dissected steps to follow [with] the particular context and the secular backgrounds of learners [having] little to do with the structure or content of the lesson” (p. 107).

According to Taubman, "connecting material to students' lives and allowing students who have not previously succeeded in school to succeed will enhance self-esteem and can help motivate all students" (2009, p. 45). By giving students the opportunity to experience success, they start to develop confidence in their abilities and this is very important when it comes to the teaching and learning of mathematics. For instance, humans have a need to feel competent and to feel a sense of pride in their accomplishment (Piaget, 1952; White, 1959; Taubman, 2009). For instance, according to Stipek, humans have an innate need to “engage in tasks, in part for the purpose of developing competence and experiencing the positive feeling of efficacy associated with successful mastery attempts” (1988, p. 43). For example, once students begin to achieve some success, they start to develop feelings of pride in their accomplishment and a level of

competence and confidence that positively affects their self-esteem and how they view mathematics. In contrast, constant failure is usually associated with feelings of incompetence and guilt and have a very negative impact on the teaching and learning of mathematics. The problem is most people have been socially and culturally constructed to feel incompetent in mathematical situations. However, according to Rasmussen in *Learning, Teaching, and Complexity* (2005) “an attempt has been made through time to solve this problem by developing teaching methods that are more sensitive to students” (p. 225). For example, two such methods of instruction currently under discussion in the field of curriculum studies and mathematics are the process and praxis models.

Process Model

Curriculum under the process model is not a prepackaged set of materials or syllabus to be covered but a free flowing evolving process that actively builds new knowledge from previous experience and knowledge. During the process, students develop thinking skills for dealing with the world as it is ...[and although] each classroom full of students may learn a different collection of content, ...all are being shaped for citizenship within the status quo of majority society (classical and societal forces in tension). (Davis, Hauk, & Latiolais, 2009, p. 352)

Under the process model, “the curriculum is not simply a set of plans to be implemented, but rather is constituted through an active process in which planning, acting and evaluating are all reciprocally related and integrated into the process” (Grundy, 1987, p. 115). According to Smith (1996, 2000), “outcomes are no longer the central and defining feature ...[students] have a clear voice in the way that the sessions evolve. The focus is on interactions. Curriculum is the interaction of teachers, students and knowledge.” In this approach the curriculum itself develops

through the dynamic interaction of action and reflection in which students acquire a better conceptual understanding and higher order thinking and problem-solving skills. Two examples of the process model which appear to show promise are the discover model and process oriented guided instruction learning (POGIL).

In contrast to the transmission and product models, these two process models may help students formulate and construct their own understandings and conclusions. Learning becomes an active process of developing one's skills and conceptual understanding. The discover model provides a means of teaching a wide variety of content ...[and] places meaning-making and thinking at its core ...Lesson plans following this model stand in stark contrast to the traditional drill-and-practice, one size fits all, regurgitation-of-facts approaches still used in many schools today. (Smith, 1996, 2000)

POGIL was designed based on research showing students who are active participants in group discussions are more likely to be successful because this type of environment not only helps to motivate and energize students but also provides teachers with real-time feedback they can use to help clarify student understandings and misunderstandings. A POGIL classroom typically consists of a number of students in small self-managed groups working on specially designed guided inquiry materials designed to help students formulate and construct their own understandings and conclusions. Logical thinking and teamwork are prized above rote memorization and drill and practice. In both models, the teacher serves as merely a facilitator or moderator of learning, not just a source of information, but someone who observes and listens and addresses the needs of the students by guiding them through an exploration or discovery process.

Curriculum as conversation: Hermeneutical Listening

In *Teaching Mathematics* (1996), Davis talks about the importance of listening. By listening to students, teachers can better formulate connections to mathematical topics and the experiences of the learners. According to Mukhopadhyay, Powell, & Frankenstein, "it is important ...to listen to students, but also to organize them using our critical and theoretical frameworks, and re-present them as problems challenging students' perceptions" (2009, p. 80). Through the process of curriculum as conversation teachers can use dialogue to create a sense of curiosity in the minds of our students. "Conventional worries about how to make the subject relevant and how to motivate learners fade to irrelevance in the presence of a question intended to engage rather than to evaluate" (Davis, 1996, p. 253). The teacher learns how to read and respond to the students in attempts to engage in productive conversation. According to Smitherman, this type of pedagogy "explores a creative conversation, one that echoes the sentiments of Davis's (1996) hermeneutical listening and Pinar's (2004) complicated conversation" (p.158). However, Reeder in *Classroom dynamics* (2005) warns us that "if the direction of the discussion is controlled and driven by the textbook or the teacher rather than the students' interests and needs, then the opportunity for curriculum as a conversation is dampened" (p. 258).

Praxis Model: Teaching Math for Social Justice

One of the biggest complaints about the process model is that it never considers whose interests are served. However if we take a process model and put more emphasis on actively engaging in emancipation and liberation we formulate what is called a praxis model. According to Davis, Hauk, & Latiolais,

within the praxis instructional paradigm, curriculum is the collective practice of teacher and students engaging with and shaping the world through knowledge of mathematics

and other content. Students are knowledge generating participants who apply their experiences of the world and understandings of mathematics to analyze and influence the world around them. Instruction is the act of supporting students in critical discourse, planning, and implementation of ideas. Students and teachers explore, challenge, and redefine the demands and constraints of multiple stakeholders in local and global communities. (2009, p. 353)

Under the praxis model, a person needs to acquire the critical mathematical knowledge necessary to bring to light that which is hidden and use this knowledge for the advancement of social justice.

In *Reading and Writing the World with Mathematics* (2006), Eric Gutstein, one of the current scholars in the field of curriculum studies and mathematics and the teaching of mathematics for social justice, posits there are three social justice and three mathematics pedagogical goals as well as three types of mathematical knowledge necessary in teaching mathematics for social justice. The first social justice pedagogical goal is for people to have the ability to “read the world with mathematics” (p. 24). Once a person has the ability to read the world with mathematics, they have the ability

to use mathematics to understand relations of power, resource inequities, and disparate opportunities between different social groups and to understand explicit discrimination based on race, class, gender, language, and other differences ...to dissect and deconstruct media and other forms of representation ... [and] to use mathematics to examine these various phenomena both in one's immediate life and in the broader social world and to identify relationships and make connections between them. (Gutstein, 2003, p. 45)

As soon as a person has acquired these abilities, they will be capable of taking action and using

mathematics to change the world in a positive way. For instance, they will be capable of fulfilling the second pedagogical goal, “writing the world with mathematics” (Gutstein, 2006, p. 27). Once a person has acquired these abilities they have a better chance of “developing positive cultural and social identities,” the third social justice pedagogical goal (Gutstein, 2006, p. 24).

The three mathematics pedagogical goals are to teach people to read “the mathematical word, ...[succeed] academically in the traditional sense, ...[and change] one's orientation to mathematics” (Gutstein, 2006, p. 24). Understanding the language of mathematics is critical in acquiring the power to read the mathematical word. From my experiences as a mathematics teacher, I would have to say that one of the biggest reasons why people can't read the world with mathematics is because, either by chance or someone's purposeful scheme, they never learned how to read the mathematical word. They never learned the basic signs and signifiers used to read and make meaning of the mathematical word. Gutstein (2006), warns us that “if one has trouble reading the mathematical word, one may have difficulty reading the world with mathematics” (p. 29).

In addition, a person needs the ability to succeed academically under our current system because throughout history educational reform has moved at a snail's pace and “issues of academic achievement are concrete, and the barriers are real. Students of color and working class and low income students are, in general, most impacted by educational underachievement, and their life circumstances suffer most” (Gutstein, 2006, p. 30). Since our culture and society view mathematics very negatively, one of the most ambitious goals is to change our orientation to mathematics. Students need to “fundamentally change their orientation toward mathematics from seeing it as a series of disconnected, road rules to be memorized regurgitated, to a powerful and relevant tool for understanding complicated, real-world phenomena (Gutstein, 2006, pp. 29-30).

Learning math is the only way for student's to break free from the oppressive reproductive cycle that is currently perpetuated.

According to Aguirre (2009) and Gutstein (2006), there are three types of knowledge critical for teaching mathematics for social justice: community knowledge, critical knowledge, and classical knowledge. Gutstein (2006) posits, "a math curriculum should consist of a balance between these three types of knowledge" (p. 200). Community mathematical knowledge is the informal mathematical knowledge acquired through a person's everyday experiences. Critical mathematical knowledge "refers to the mathematical knowledge required to analyze the power relations, social injustices, and inequities that affect our individual, community, and global lives" (Aguirre, 2009, p. 300). According to Gutstein (2006), "critical mathematical knowledge [is the] knowledge of how to read the world with mathematics" (p. 202).

"Classical mathematical knowledge" according to Aguirre, "refers to the mathematical power and competencies needed to make meaning in the world, past gate-keeping educational and vocational test, and pursue advanced mathematics and mathematics related careers" (2009, p. 299). Mukhopadhyay, Powell, & Frankenstein (2009) suggest that this type of knowledge amounts to our "current traditional, globalized academic mathematics" (p. 79). Classical mathematical knowledge is the type of knowledge a person usually learns in school and is vital if a person hopes to succeed academically. The problem is according to Gutstein (2006)

from a Freirean perspective, community and critical knowledge are closely interconnected, but currently in U.S. schools, classical knowledge is generally divorced from both. Students do need to develop mathematical power to understand the complexities of society, but some aspects of classical knowledge are unnecessary and imposed. ...some of the mathematics they have to know, and how they have to know it

(e.g., rote memorize formulas to quickly produce correct answers on narrow, multiple-choice questions), may have little to do with either understanding mathematics or with making sense of and changing the world. (p. 205)

Many students lack the motivation to acquire this type of mathematical knowledge because of previous experiences or because it is just not relevant to their everyday activities.

Although our populace lacks all three types of mathematical knowledge, the type of knowledge most lacked by the masses is critical mathematical knowledge. But why? If this type of knowledge is so vital, how come so many people lack it? Maybe this is just an indirect result of our current system of teaching, but it could also be a well-planned system used to control this knowledge in order to maintain the current level of manipulation. For example, students “explicitly use mathematics to understand inequality, critique social structures and arrangements, and become active in movements to restructure society for justice and equity” (Gutstein, 2006, p. 119). Therefore, if someone was interested in perpetuating injustice and inequality, it would behoove them to make sure people never acquire any of these three types of mathematical knowledge. Once a person acquires this knowledge he/she has the ability to liberate and empower themselves. Once they acquire some critical mathematical knowledge, people begin to see the value and power of mathematics thus changing many of their previous views of mathematics. Once our eyes are opened and our views are changed, most of us are highly motivated to learn mathematics.

Culturally responsive mathematics education

One of the major points that I want to make throughout this discussion is that our historically, culturally, and socially constructed views of mathematics play a prominent role in our motivation and desire to learn math. Many argue that a culturally responsive mathematics

education can work to motivate students to learn math by showing them that math is not some mysterious entity, but a social and cultural construct. For example, Paul Ernest, in *New*

Philosophy of Mathematics (2009) posits

the reconceptualization of mathematical knowledge as a cultural and social construction demystifies the concepts, results, proofs, methods, and theories of mathematics and sees them not as something extrahuman imposed upon humanity, but as something created and shaped by human concerns, interests, powers of reasoning, and historical and social practices. . . . A culturally responsive mathematics education needs to acknowledge the pan-human origins and presence of mathematics and all of its diverse forms. (p. 56)

According to Gay,

Central to cultural responsive teaching is the belief that culture influences teaching and learning in fundamental and profound ways [because] all people are social and cultural beings, and all dimensions and expressions of their humanness are shaped by and reflect their cultural socialization to some degree. (2009, p. 197)

Motivation is linked to cultural beliefs, values, and practices and functions to guide social behavior.

People who theorize on culturally relevant mathematics speak of how different cultures can have different views concerning mathematics. This could help explain why students from other countries are . . . successful in our schools when our students are not. For instance, in the United States, most Asian students often do very well in mathematics courses because according to Swetz in *Culture and the Development of Mathematics* (2009), they come from

backgrounds with Confucian traditions that promote education. Although there might be yet undetermined cognitive traits that allow the students as a group to do well,

investigations indicate that their advantage lies in attitude and motivation... it is found that Asian American students: believe that the path to personal advancement lies in education ... success depends on hard work. (p. 37)

When compared with other countries, many in the United States “give more importance to native ability [and] think of mathematics as some esoteric skill like perfect pitch that some people have and others do not” (Appelbaum, 1995, p. 139). They have been manipulated by many of the common myths perpetuated concerning mathematics.

Studies show a "culture-based education systematically produces greater student engagement, greater parental involvement, better attendance rates, lower dropout rates, better graduation rates, and general satisfaction of all participants, as opposed to a standard, traditional program based on mainstream models" (Mukhopadhyay, Powell, & Frankenstein, 2009, p. 76). "Knowledge about students cultural and linguistic backgrounds may contribute to teachers ability to establish the kinds of relationships with students that motivate them to succeed” (Moschkovich & Nelson-Barber, 2009, p. 112). For instance, Swetz argues that “where possible, mathematics and its teaching should reflect its historical and cultural background. Such an association personalizes mathematics. If one has a particular cultural connection to mathematics, it is meaningful and may become a source of pride, even empowerment” (2009, p. 38). The concepts formulated by many of the scholars in culturally relevant pedagogy help to answer many of the questions about the link between our culturally constructed views and our motivation to learn mathematics.

Reform Standards

Standards and Standardized tests

Although the testing movement was born in the early 20th century, it was reinvigorated in

1957 after the United States government was shocked to find out that the Soviet Union had become the first country to put a satellite into orbit. How could this be possible? For example, at the end of World War II many considered the United States the most technologically advanced country in the world. However, the Sputnik event created the perception that Russia was now the new leader. This sent US officials into a panic scrambling to explain how this could happen. However, throughout their investigation they never considered the broad possibilities or complex combinations that may have created this environment. Instead they focused solely on our education system. For example, the problem had to be because of our educational system and not our historically, socially, and culturally constructed attitudes and perceptions about education, especially mathematics and science. Therefore it was decided to establish some type of benchmark or standard to evaluate student progress in order to make sure we were getting our money's worth out of our educational system. If these standards are not achieved, if students are unable to reach some basic level or score on some type of standardized test, then someone would have to be held accountable.

Although the testing movement was intended to make sure that all students received a quality education and learned the information needed to function in a global society, today it has evolved into something completely different, many times causing more harm than good. Testing has now evolved into a means of social control and oppression. However, today, there are many scholars in the field of curriculum studies and mathematics investigating the standards movement and its many issues. One of the major questions is: Do scores on such tests give us usable information or are they meaningless? For example, there have been numerous people who have failed to make a sufficient score on the SAT or ACT, but when admitted to college on a provisional basis often go on to graduate. We are told that testing is used to weed out students

with low scores who will not be able to pass college level subjects anyway, creating the perception that testing is doing the students a favor. However, throughout my teaching experiences, I have seen many of the students who come through our Eagle incentive program go on to graduate. This program gives students with test scores too low for regular admission a second chance to go to college. In addition, I have seen students with perfect scores on such tests unable to do basic college work. So do these tests really serve a purpose? I would have to say no. Once again it all has to do with attitude and motivation and not some test score.

But if these scores are not really measuring what they were designed to do and because of all the social issues associated with these scores, why do we still use testing? In *Teaching by Numbers* (2009) Peter Taubman, a major scholar in the field of curriculum studies and mathematics, posits that it is because of "the audit culture that pervades schools today ... The push for standards and accountability, has resulted in huge profits for several companies such as McCraw Hill, IBM, Pearson, and ETS K – 12" (p. 20). Although the Standards movement has been around for some time now, many students still graduate high school without the mathematical skills and knowledge necessary to function and survive in a capitalist society. According to Taubman, these tests only perform a "gate-keeping" function, because "none of the tests are correlated with college, professional, or economic success" (2009, p. 27).

However, in addition to creating a barrier, these tests also help reinforce stereotypes. For instance, scores on these test are used to classify people as smart, dumb, nerd, or geek.

According to Taubman (2009),

the implementation of standards renders diverse groups similar, but creates inequalities, since a hierarchy emerges as a result of the original contextual differences. We see this in the standards movement in education, in which standards render all groups, individuals,

communities, histories as synonymous, commensurable, interchangeable, while they diminish, mask or elide, in the name of neutrality and equal treatment, inequities in resources, power, access, and treatment. But because there are disparities of resources, power, histories, abilities, and interests among individuals and groups, the standards produce a hierarchy of differences among these groups and individuals, differences that are then cast as the fault of the schools, the students, the teachers, or the families. (p. 114)

In other words, testing functions to create an achievement gap based on race, gender, and social status. Although testing was thought to be a solution to our education problem, it has resulted in the creation of many new problems. One of the problems is how these scores can follow a person for their entire life functioning as a gateway that restricts access to the various resources needed to become a complete person.

Another major problem with standardized tests is that many of these test scores determine the amount of federal money the schools receive and therefore administrations push teachers to increase test scores or be held accountable. The problem is many students have given up on school and therefore could care less about taking a test. Therefore, they have no motivation or incentive to try and be successful on such tests. For example, when I was a middle school teacher, I can recall student's who would complete a fifty minute test in under two minutes by selecting a, a, a, a, a, a, a, a, a or b, b, b, b, b, b, you get the point. The students would write anything in order to be finished and take a nap. These tests were considered an inconvenience, a form of punishment that everyone had to endure. Although these students could care less about their accountability and are eventually held accountable through economic exploitation, the teachers and the school were still held accountable for the scores on the test. With this increased accountability, especially with the push for teacher merit pay based off student scores, there will

be many teachers caught with their hands in the cookie jar, changing the answers on student tests in order to increase their numbers. However, unless we can get every student to try their best, the scores on such tests are meaningless.

So how can we motivate students to do their best on such tests, when most people consider taking a test some type of punishment? It is easy to see how testing functions to create negative attitudes about mathematics. According to Davis (1996),

evaluation in mathematics classrooms is overwhelmingly regarded as a negative process.

There seems to be at least two central reasons for this pervasive perception. First those who are marked and graded tend to believe that evaluation is something that is done *to* them *by* someone else. It is an imposition of authority, a naming, an objectification of one's fluid self. Second, save for those persons who do exceedingly well on such evaluations (and, hence, learn virtually nothing from them), formal evaluations do not focus on the positive side of what we know and what we are now capable of learning, but on the negative side of what we can't do or what we got wrong. (p. 247)

Therefore math testing functions to exacerbate the problem by reinforcing negative perceptions of mathematics and reducing the student's level of competent motivation. For example, Harter (1978) used a method to test the problems caused by grades. She separated elementary children into two groups. One group was told that they would be choosing problems to solve in a game setting, while the other group was told that they should choose problems to solve for a grade. The game students asked more challenging questions and experienced a high level of enjoyment. On the contrary, the grade students asked to solve easy less complex problems with a high degree of anxiety.

Considering all of the problems associated with math, why teach it?

Considering all of the problems associated with math, why teach it? For example, in *Teaching Mathematics* (1996) Brent Davis states that “mathematics has been associated with the establishment and maintenance of power imbalances; contributing to wide-scale destruction of the planet; and disenfranchising and depersonalizing the citizenry of Western cultures... all in the name of 'progress’” (p. xxii). According to Gutstein (2009), mathematics education in the United States is a tool used to “serve capital ...[and] advance U.S. global dominance rather than the interests of humanity” (p. 138). Many scholars are concerned about how “courses in mathematics have assumed a 'weeding out' or 'gatekeeping' role” (Davis, 1996, p. 144) that function to limit and deny people opportunities. Mukhopadhyay, Powell, & Frankenstein warn us that this is nothing new because “mathematics has too often been implicated in exploitation of people for profit, and generally for dehumanized and mechanistic forms of control” (2009, p. 67). “The most commonly cited argument for studying mathematics is that the subject matter has a particular utility within our culture – an argument that, if made in reference to the actual concepts studied, is simply wrong” (Davis, 1996, p. 144). I agree with Davis that today the curriculum is disconnected from the types of knowledge needed to be useful in our society.

When considering all the problems associated with mathematics education and the fact that we are not even close to fulfilling the purpose of mathematics education, why don't we just get rid of it? For example, although I am sure that it was never intended, mathematics has become another one of Lyotard's (1984) grand narratives used for the purpose of legitimizing power relations. The use of standardized tests in an attempt to hold teachers, students, and institutions accountable has resulted in the control and oppression of many. According to Davis, Nodding's (1994) suggests there is “no morally or practically persuasive reason why lack of mathematical preparation should impose a debilitating economic hardship on all minorities or on

any of the individuals who contribute significant work to our society” (1996, p. 146). I agree wholeheartedly with this statement. However, the reality is, it does. Therefore, it is our moral obligation to do everything in our power as educators to make sure that our students obtain this knowledge. Since our current curriculum and pedagogy is not working to solve the many problems associated with mathematics, Davis (1996) states that he is

unable to provide a satisfactory defense for the mandatory study of mathematics in its present form ... [and agrees with] Noddings, Walkerdine, and Shelley ... that maybe math should be eliminated from the curriculum or at the very least current requirements relaxed. (p. 146)

However, this is not the answer. We would be the only country in the world not working hard to educate their students in the mathematical skills and knowledge necessary to survive and be in the world. For example, I haven't heard of any educators from China or India advocating to remove mathematics education. We need to understand that a lack of this knowledge could cause more of a hardship on students not because of some test score but because this knowledge could give them the power to function in society.

What is mathematics and why should we teach it?

What is mathematics and why should we teach it? When pondering this question, I think back to the beginning, back to a time when humans were new on the planet and first contemplated the idea of mathematics. According to Paul Ernest in *New Philosophy of Mathematics: Implications for Mathematics Education*, “the invention of mathematics is often inspired by real world problems and situations” (2009, p. 44). After reading Jacob Klein's *Greek Mathematical Thought and the Origin of Algebra* (1968), I have come to the conclusion that mathematics is a human construct “of forming concepts and of interpreting the world” (p. 171)

that arose out of a practical need to count, measure, or find solutions to problems of life. As we evolved, math became more than just a simple tool for counting and measuring and began to take on a more abstract meaning. According to Gutstein, “mathematics is a human activity involved in social interaction, production, and intellectual abstraction” (2006, p. 102) that is

comprised of a diversity of practices that make it as historically, culturally, socially, and politically situated as any other human activity. It is grounded in human interactions with the environment and with one another, and the solving of practical problems and the human desire to transcend matters of simple survival, in universal human traits such as the use of physical and mental tools, the decorative impulse, and pleasure in intellectual play. Over millennia, academic mathematics has evolved from these origins, and continues to evolve, as a very special kind of cultural activity. But academic mathematics is only one, albeit a very special case, of the many forms of mathematical practice.

(Greer, Mukhopadhyay, Nelson-Barber, & Powell, 2009, p. 1).

In *Culturally Responsive Mathematics Education* D’Ambrosio, posits that, “the history of mathematics, when we focus on the dynamics of cultural encounters, shows that mathematics is, effectively, mankind’s worldwide, transcultural endeavor in the search for survival and transcendence” (2009, p. ix). According to Swetz, “mathematics is a cultural phenomenon. It reflects the culture it serves and, in turn, is shaped by that culture” (2009, p. 13).

So in trying to answer the question what is math? I have come to the conclusion that mathematics is a language like English, Spanish, or music. However, mathematics is a language used to study patterns and represent reality with numbers, symbols, equations, signs and signifiers. A language like any other used to communicate meaning, a tool used to count, measure, locate, explore patterns, design, and solve real world problems and situations. A

language that has been shaped by our social and cultural encounters. But today living in a postmodern world, the concept of mathematics takes on new meanings. For example, according to Brent Davis in *Teaching Mathematics* (1996),

if the current philosophical and theoretical debates are any indication, the question, What is mathematics?, is an unanswerable one – and fortunately so. Were we able to decide once-and-for-all what mathematics is, we would doubtlessly give in to our modern tendencies of exorcising ambiguity and mechanizing complexity, in effect reducing a fluid form to a static formula. (p. 59)

Math has become something more than the hard or crisp sets of the past and has evolved through the influence of postmodernism to something never imagined, something dynamic, complex, and chaotic. Therefore, according to Davis, there is no way to answer this question because mathematics is in a constant state of flux, ever changing, growing and evolving. We can see these changes in the areas of mathematics and curriculum studies where concepts such as non-linear dynamics, chaos theory, and complexity theory have weaved their way into the conversation.

Why should we teach mathematics? Many claim that math education should prepare one for life, a concept we have seen passed down throughout our history of curriculum. But what exactly does that mean? According to Appelbaum (1995), the NCTM goals of mathematics education are to “encourage students to become mathematically literate workers, who are lifelong learners, with equal opportunity for all students so that we can have an informed electorate” (p.181). Gutstein (2006), suggests the purpose of mathematics education is to prepare students

to investigate and critique injustice, and to challenge, in words and actions, oppressive

structures and acts – that is, to "read and write the world" with mathematics ... essentially to read the world is to understand the social political, cultural-historical conditions of one's life, community, society, and world; and to write the world is to effect change in it.

(p. 4)

Moses, West, & Davis in *Culturally Responsive Mathematics Education and the Algebra Project*, claim the purpose of math education is “to develop young leaders and organizers who radically change the quality of education and quality of life in their communities so that all children have the opportunity to reach their full human potential” (2009, p. 252). Therefore, Davis (1996) comes to this conclusion by stating

It seems that we are trapped in an untenable position: between seeking to preserve what we hold to be a valuable part of our intellectual heritage and avoiding the perpetuation of a dehumanizing practice... To understand the universe in which we find ourselves and in which our selves are established, the study of mathematics, like studies of language and history and art and music, is critical. The suggestion that we disregard the discipline is tantamount to the recommendation that we ignore who we are and who we might be – and what our society is and what it might be. We study mathematics not to master its processes or to possess its objects, but to understand the world into which we are thrown and which we participate in creating. (p. 147)

Since we are caught between a rock and a hard place when it comes to the teaching and learning of mathematics, it is our moral obligation to make sure that we educate our students and not take the easy road of making excuses and just give up. Others suggest that the answer is not to eliminate mathematics but to find ways to inspire and educate our students to become all they can be.

Conclusion

Throughout this chapter, I have gained a better understanding of the purpose of mathematics education. For example, some people have argued that the purpose of mathematics education is to prepare a person for life by giving them the skills and abilities to survive. Others have argued that the purpose of mathematics education is to teach the person a specific trade or as a means of moral development. Still others argue the purpose of mathematics education is to give people the ability to fight for social justice. I think the purpose of mathematics education is to empower students by giving them the knowledge and skills necessary to function in the world, as it currently exists, informed enough to make educated decisions that benefit us all. However, from my experiences as a math educator, I have started to question if it is possible to achieve these goals. For example, it is clear from all the mathematically illiterate and innumerate people who have graduated from our educational institutions that we as a society are not fulfilling the purpose of mathematics education.

A majority of our students graduate from high school and college innumerate and mathematically illiterate with a shaky grasp of anything considered numerical or mathematical. Because of this many are unable to compete in the global workforce and typically get stuck in all of the low paying service jobs. Until the masses obtain the mathematical knowledge, basic level of numeracy, and critical thinking skills necessary to critically analyze and process the numerical information that is disseminated throughout our society and culture, mathematics will continue to be used and perceived as a form of oppression. Under this type of environment, the goal of a more democratic and morally just society will never be realized. For example, without this knowledge and ability people can be easily manipulated and taken advantage of, resulting in a less informed and morally unjust society where a lack of mathematical knowledge and ability

restrict opportunity, exploit, and oppress.

As I examined some of the major movements in the history of curriculum and curriculum studies, I gained a better understanding of the roles that each of these movements in association with schools, teachers, mathematics curricula, and pedagogy have played, both positively and negatively, on our historically, socially, and culturally constructed attitudes, perceptions, and norms concerning education and mathematics. When I consider that most of these views are negative, it is easy to see why we live in an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate. For instance, historically, math has been associated with fear, punishment, resistance, and reproduction. This is probably the result of the early American schools that used fear, punishment, and humiliation to control classroom behavior and to motivate students to learn things for which they had no interest. According to Pinar (2004), an authoritarian environment was necessary in schools because many considered that “the only way to force children to excel in tasks in which they have little *interest*” (p. 255). This could be why schools are associated with prisons.

However, today nothing has changed, because for many, the fear of punishment and humiliation are still the primary motivation to learn. The problem with this methodology is that certain psychological and physiological needs have to be met before people will have a desire to learn, and the authoritarian nature of school goes against many of these needs. Children learn best when they learn material for their own intrinsic reasons. For example, a study by Rainey (1965) of high school science students found that when students were allowed to set up their own experiments they showed more interest and involvement in the labs than the students who were given detailed instructions. Stipek (1988) posits, “humans have an innate need to feel that they are autonomous and engaging in activities by their own volition” (p. 39). The need for autonomy

is why humans are rebellious by nature in authoritarian environments such as schools. People have a need to feel self-determined and will only tolerate authoritarianism to a point before they start to resist. This resistance leads to animosity, which eventually turns into fear, anger, and then hate. A person's experiences in a school environment associated with the fact that schools and teachers have historically used fear and humiliation as a motivation for learning create a very negative perception of mathematics, or learning in general.

All of the major movements in the history of curriculum play at least a partial role in how we view mathematics today. For instance, with the exception of the progressive movement, all of the other movements never considered the interest or needs of the student in the construction of a curriculum and this has resulted in math having little or no relevance in the lives of students. Today we can still feel the influence of Frederick Winslow Taylor and the social efficiency movement on the testing movement as well as how, "it is commonplace for teachers to break up each of the living disciplines that form the human inheritance into easily deliverable bits and pieces that are doled out to students in ways that can be efficiently managed and controlled" (Jardine, Friesen, & Clifford, 2006, p. 205). Although the intent of the tests were to insure that students reach some minimal level of ability and not be left behind, in the age of accountability they have become a means of discrimination and oppression, responsible for many of our social issues. That is why today many people perceive standardized testing and any other type of assessment or evaluation, forms of punishment, something done to them by someone of power, something to be feared. The pressure of standardized tests produce a dislike for any subject, and since mathematics is such an important part of these tests, it is easy to see why so many people have such negative perceptions of the subject.

As I examined our current mathematics curricula and pedagogy, I realized that they have

played an influential role in constructing our historical, cultural, and social views of math and math education. Although some people have had positive experiences and constructed a positive view of mathematics, most have had only negative experiences which has resulted in the construction of negative views that seriously impact the motivation and desire to learn mathematics. However, “teachers can do a lot to redirect these attitudes in students” (Gay, 2009, p.195). For instance, throughout this research, I have gained a better understanding of the power and influence that teachers have in constructing our attitudes and perceptions of mathematics. Although some teachers can have a positive influence on students regardless of the curriculum, pedagogy, or methods used, some may have a detrimental effect on mathematical attitudes and perceptions.

However, contrary to belief, teaching does not imply learning. Teachers are only a small part of the puzzle when it comes to learning mathematics. For example, although teachers can play an important role in the learning process, we need to be realistic and understand that “learning must be understood as a process by which the person, was learning himself or herself actively, through operations, constructs his or her own knowledge” (Rasmussen, 2005, p. 215). Just because I teach a class on a particular topic does not mean that my students learn what I intended. “Whether or not it happens depends entirely on the learning person. Learning is the student’s own output” (Rasmussen, 2005, p. 216). Furthermore, “one never knows exactly what one will learn – just as, on a broader level, one can never predict the directions in which mathematics and other facets of collective knowledge might evolve” (Davis, 1996, p. 90). Each student may learn something different during the experience. This is why according to Rasmussen “the production of understanding in schools today takes place, to a great extent, at random... The teacher teaches, but there is no guarantee that his efforts will lead to an

understanding on part of the students” (2005, p.225). This could explain why some people are good at math and others are bad. It is all random. However, if the student doesn’t desire the knowledge then they will not be motivated enough to seek it out.

As I examined what is currently happening in the field of curriculum studies and mathematics, I immediately noticed the influence of the reconceptualization movement. Also, I noticed a push away from the transmission and product models currently prominent in mathematics education, to models such as the process and praxis models that give students a voice and encourages them to actively participate in their own learning. I see great promise in the process and praxis methods of instruction because the idea of engaging in conversation with students as part of the learning process is very intriguing. I agree with Davis’ concept of hermeneutical listening because there are many lessons that a person can learn by simply listening. I am an advocate for teaching mathematics for social justice and feel that we should teach all students to liberate themselves and others from oppressive environments. Mathematics education should always be about empowerment and liberation. I agree with the many who say we need to change our current mathematics curriculum and pedagogy; however, I disagree with those who suggest we shouldn’t teach math or we should at least relax the current math requirements because our current requirements and curriculum are not enough for a person to make critically informed decisions concerning the many complex issues of life.

Throughout this chapter, I have seen how our historically, socially, and culturally constructed values and perceptions concerning education and mathematics play a serious role in our desire to learn. For example, these values and perceptions are some of the major reasons why students from other countries are successful in our schools but our own citizens are not. It has more to do with cultural values and work ethic than any curriculum or pedagogy. People in other

countries have been historically, socially, and culturally constructed to view mathematics as something that all students should obtain, they understand its value. However, in the United States, our attitudes and perceptions of mathematics have become so negative that they function to create an environment where people have no motivation or desire to participate in anything considered mathematical. Because of our perceptions and previous experiences, many people avoid, shun, fear, or have a great disdain for the subject. However, one of the key elements associated with the teaching and learning of mathematics is the student's motivation and desire to obtain this knowledge. For example, according to D'Ambrosio "the advancement of knowledge and understanding of mathematics, once the ground is fertile, is a matter of motivation" (2009, p. ix).

Dewey in *Experience and Education* (1938) claimed that the problem with traditional education was that teachers took for granted the purpose of the child and in doing so, failed or underestimated the child's motivation or interest in the subjects being taught. Topics and discussion have to be of some interest to the students. For example, "if learning is not meaningful to the students, it is irrelevant what the teacher does" (Wink, 2002, p.75). The problem is motivation and desire are key elements when it comes to the teaching and learning of mathematics, but today certain aspects of our teaching methods such as drill and practice and rote memorization are boring and therefore create a lack of interest or desire, and according to Swetz "if children are not interested in or attracted to mathematics, if they do not consider it important, they will not study it effectively. We do not learn what we do not want to learn! " (2009, p. 38). As I reflect on my experience as a mathematics teacher, I can say that our historically, socially, and culturally constructed values, perceptions, and norms of mathematics determines the amount of motivation people have to learn math and since many of these views

and perceptions are negative, masses of people have no desire to learn and as a result mathematics becomes a gateway. Therefore, if we are ever going to be successful in educating our students in mathematics, we need to change our cultural and social views of mathematics, and according to Mukhopadhyay, Powell, & Frankenstein (2009), “a culturally responsive mathematics education is a way to change our current cultural and social views of mathematics by exposing and challenging our historically constructed beliefs and the myths associated with math” (p.74).

Although, our present mathematics pedagogy and curricula does play a role in the construction of these attitudes, there are many other cultural and social factors in play. For example, let’s consider that we formulated the perfect mathematics curriculum and pedagogy and considered many of the ideas discussed throughout this chapter, would that guarantee that learning was taking place? According to Taubman (2009) even if we try all of these things, “we cannot claim that these motivate students to learn” (p. 178). The problem is that these attitudes and perceptions tend to play a greater role in the teaching and learning of mathematics than any particular mathematics curriculum or pedagogy. However, if a change in mathematics pedagogy or curriculum could change our current negative perceptions and attitudes that precipitate and lie embedded in American Culture when it comes to the teaching and learning mathematics, I am all for it.

CHAPTER 3
ISSUES OF RACE AND GENDER ASSOCIATED WITH EDUCATION AND
MATHEMATICS

In this chapter, I will explore our historically, socially, and culturally constructed attitudes and perceptions of education and mathematics and the roles that race, gender, and social class play in the construction of these views. I would like to gain a better understanding of how power is associated with the construction of our attitudes and perceptions concerning education and mathematics, and how these views have functioned to legitimize and reproduce gender, racial, and class relations. I hope to gain a better understanding of how and why education and mathematics have been used historically as gatekeepers to weed out certain groups. Although I can't see why we as a society have allowed education and mathematics to become gatekeepers, Joel Spring argues this is nothing new because historically "educational policies have served the interests of those wanting to take advantage of others" (2004, p. 1). But in whose best interests is it to keep the masses or certain subgroups uneducated? What could be their rationalization for such an act? Therefore, throughout this chapter I will explore how education and mathematics in association with all of the characteristics, stereotypes, myths, and stories concerning race, gender, and social class are used to discriminate and oppress, and how they have worked to create negative attitudes and perceptions of mathematics and education, that are still very prevalent today, and have a serious impact on a person's desire to learn.

Issues of Race and Gender associated with education and mathematics

Achievement Gap

I often hear that one of the biggest issues with education and mathematics, when it comes to race, gender, and social class, is the achievement gap. According to the National Center for

Education Statistics, the 2011 math SAT scores have an overall mean of 514 with the mean score for men being 531 and the mean score for women at 500. When classified in terms of race, the Asian and Pacific Islanders come out on top with a mean score of 595, while Whites come in second with a mean score of 535. Native Americans and Alaska Americans have a mean score of 488, while Mexican, Hispanic, Puerto Rican, and Black range from 427 to 466. However, do these statistics tell us anything of value or are they just a means to perpetuate racism and sexism? For instance, when it comes to reality, these measures are questionable at best. If we were to consider these scores as some legitimate measure, then it is easy to see that gaps do exist, but why? Isn't it interesting that advocates of standardized testing claim that testing is necessary to insure that no child is left behind and to close any gaps that exist in achievement? However, we have been using standardized tests for many years now and the gaps just seem to be getting larger. Freire warns us about how the powerful will do almost anything to remain in power ranging from "repressive methods of the government bureaucracy to the forms of cultural action with which they manipulate the people by giving them the impression that they are being helped" (2004, p. 141).

Therefore, standardized tests are responsible for many things but it doesn't seem that they have made any impact on actually closing the achievement gap. Furthermore, test scores have now become a means to discriminate, exploit, oppress, and perpetuate and reproduce racial, gender, and class relations, a gatekeeper to restrict access to higher education and social mobility. For example, according to Taubman in *Teaching by Numbers* (2009),

educators and teachers have always used tests of various sorts, as both formative and summative assessments to provide some limited sense of what students know or can do at a particular moment in time. ...[However these tests have a long history of abuse as

sorting and gatekeeping devices] as is clear from the history of IQ testing, the eugenics movement, and bias in admission to elite colleges and high schools.” (p. 52)

For example, “quantitative tests of aptitude and achievement have given U.S. education a way to sort children by race and social class, just like the old days, but without the words 'race' and 'class' front and center” (McDermott & Hall, 2007, p. 11). The question is why?

If we consider the concepts of culturally responsive mathematics teaching, then we know that different cultures have different views of mathematics and these views determine the amount of motivation and desire a person will have to learn mathematics. For example, our historically, socially, and culturally constructed attitudes and perceptions about education and mathematics are different from the attitudes and perceptions of people from other cultures. Many people living outside of western society are fortunate and have never been influenced and conditioned by the many negative influences and anti-intellectualism associated with education and mathematics that we have faced. This would suggest that social and cultural influences could be a reason for the existence of such gaps and not a person's race, gender, or social class.

What are some of the possible reasons for the achievement gaps in the United States?

In a capitalist society where knowledge is power, there are many reasons for the powerful, the people who control the knowledge, to make sure that they limit the amount of education available to the masses thereby using education as a form of control and oppression. Wealth is very important in our culture because it can determine a person's access to services such as education, health care, and general quality of life. But capitalism is about accumulating more and more wealth, and if knowledge is associated with power and wealth, there will be people who do everything in their power to obscure that knowledge from the masses no matter the consequences. However, this seems counter-productive in a democracy. For example, many

of the founding fathers advocated for an educated populace, because they knew that without an educated and informed electorate a democracy would never survive. Thomas Jefferson “articulated the inseparable relationships between popular education and a free society” (Anderson, 1988, p. 1). He believed “that ignorance was the greatest enemy of the common good. ... [and that everyone should be educated at public expense; however, everyone did] not of course extend to slaves or women” (Jacoby, 2008, p. 49). His publicly funded education was only for white children of the common wealth and in many cases this only included wealthy white males. Native Americans, African Americans, women, and most poor white males were not considered in this relationship. Although they spoke of an educated populace, in reality they wanted to limit the amount of education to certain groups as a means of social control, a process that still goes on today.

Therefore, many blame the gaps on what Gutstein (2006) calls “*sedimented inequality*, the advantages ... [or disadvantages,] passed down through the generations” (p. 61). Wealth is an important component of sedimented inequality because if we look back historically, we can see that most poor people have always had less access to education and many were denied access to an education all together. Oliver & Shapiro (1997) and Gutstein, (2006) posit that *sedimented inequality*, is the reason why African-Americans have less accumulated wealth than whites. However, sedimented inequality isn’t just a racial issue, it is also an economic issue because all poor people no matter their race, gender, or ethnic background suffer. For example, there have been many studies that have concluded a person's social class made a big difference in academic achievement and standardized test scores. According to Valerie Walkerdine in *Counting Girls Out* (1998), in terms of gender "the situation at present is divided sharply along class lines" (p.169).

Therefore, if wealth determines academic success, it is important that we examine the impact of poverty on education and mathematics. For example, the national average given by the 2011 U.S. Census was that 16% of the people live in poverty and struggle to survive. The Census showed that in terms of gender, 13.6% of the people living in poverty were male and 16.3% were female. In terms of race, White and Asian were at 12.8% to 12.3% respectively while Black and Hispanic were at 27.6% and 25.3% respectively. When looking at standardized test scores of people living in poverty and those who do not, it is easy to see an association between wealth and education. Therefore, it is reasonable to assume that sedimented inequality and lack of accumulated wealth could be explanations for an achievement gap.

I believe a gap exist because of our historically, socially, and culturally constructed perceptions and attitudes about mathematics, race, gender, and social class. Views that function as tools of hegemony that have become so embedded in our culture that today many people consider them the norm. Many believe that the achievement gap is a myth that no longer exists in the United States and some suggest there never was a gap in achievement, just sexism and racism. For example, Taubman (2009) and Martin and McGee (2009) posit that the gaps are caused by discrimination, lack of resources, and economic, social, and cultural bias. Martin and McGee "argue that so-called achievement gaps – much like the concept of race – are socially constructed phenomena ...Rather than gaps, discriminatory forces and inequitable access to resources have produced *lags* in achievement" (p. 219). Although mathematics education should be about empowerment and liberation, it has functioned as a form of labor control, economic exploitation, and cultural intolerance. Looking back historically, it is hard to deny the existence of discriminatory forces working to guarantee an inequitable access to resources for people considered inferior or different. That brings us to the concepts of race and racism which have

definitely played their parts in producing these lags in achievement.

History of Racism and Education in America

What is Race?

According to David Freeman (2015), the concept of race probably originated “from Aristotle’s predilection with classification.” In terms of humans, race was used to describe where in the world a person originated, for example, Africa, Asia, or Europe. However it quickly became a means to rationalize the inhumane treatment and sometimes genocide of those considered different. According to Eliza Sankar-Gorton (2015),

the concept of human races began during the Spanish Inquisition (around 1480), when a purity of blood decree was established and those converting to Christianity (or converses) needed to prove their Christian origins. Racism became even more established a bit later, during colonization.

Botanist Carl Linnaeus (1707–1778) was one of the first people to move from a cultural classification of race to a biological system of classification. Williams Watkins in *The White Architects of Black Education* (2001) states that, “in 1735 Carolus Linnaeus ...used both skin color and personal characteristics for his topology” (p.27) and in 1759 was the first to describe four races of man. According to Winthrop Jordan in *The White Man’s Burden* (1974), Johann Friedrich Blumenbach continued the work of Linnaeus and in 1781 “described five varieties of men, and in 1795 [coined the] ...remarkably adhesive term *Caucasian*” (p. 101) to describe one of the five varieties.

Once these varieties of men were established, there was a move to rank these varieties in terms of inferior or superior characteristics including but not limited to physiology, intellect, and morality. Since “the most common assumption was that the original color of man was white”

(Jordan, 1974, p.109), many believed that Whites were superior to other races in most if not all of the established characteristics. These classifications created a hierarchy where according to "Dr. Charles White, a reputable member of the Royal Society ...Europeans were highest and Africans lowest on the scale" (Jordan, 1974, p. 199). For instance, Whites or "American-born Caucasians of Anglo-Saxon heritage" (Jacoby, 2008, p. 68) were ranked on top in society and Blacks were somewhere near the bottom. However, as Jordan (1974) warns "when Europeans set about to rank the varieties of men, their decision that the Negro was at the bottom and the white man at the top was not dictated solely by the facts of human biology" (p. 103). For example, in *The Uses of Culture*, McCarthy talks about how these racial classifications were used to rationalize slavery.

According to Watkins (2001), some people argued using science, that Blacks and Native Americans were a totally different species and "not just a lesser-developed people" (p. 30). This is understandable considering that "English observers in West Africa ...frequently described the Africans as 'brutish' or 'bestial' or 'beastly.' The supposed hideous tortures, cannibalism, rapacious warfare, revolting diet seemed somehow to place the Negro among the beasts" (Jordan, 1974, p.14). This helped promote and rationalize the treatment of human beings as animals. For example,

a few commentators went so far as to suggest that Negroes had sprung from the generation of ape-kind or that apes were themselves the offspring of Negroes and some unknown African beast. ...[however] the notion that Negroes stemmed from beasts in a literal sense was not widely believed. It simply floated about, available, later, for anyone who wanted it. (Jordan, 1974, p. 16)

Blumenbach believed that "all men belong to the same species, and his groupings were merely

varieties. The differences among men, he insisted, were not nearly so great as those which separated men from apes” (Jordan, 1974, p. 101). Nevertheless, race no longer would just describe where a person originated, it would now be used to describe personal characteristics and cultural differences in terms of inferior and superior status with the intent of creating what Freire calls the “other.” The classifications of race would become a means to socially, culturally, and economically oppress those considered inferior. These classifications helped to reinforce, justify, and make legitimate the discrimination, oppression, and persecution of Native Americans, African Americans, and various other ethnic or minority groups.

According to Jordan (1974), people such as Thomas Jefferson reinforced the idea that “blacks [were] inferior to whites” (p. 166) and his writings help to reinforce the “popular tradition of Negro inferiority” (p. 193). Jefferson believed blacks were equal morally but not intellectually. However, there were many people who believed that Jefferson was wrong about the intellectual ability of blacks. For example, according to Jordan (1974), people such as Benjamin Rush in 1773, Gilbert Imlay in 1792, and William Pinkney in 1789, argued that there was no difference in mental ability between the races. For example, Imlay “set out to refute Jefferson at some length, saying flatly that 'it is certain' that blacks and whites 'are essentially the same in shape and intellect'"(Jordan, 1974, p. 175). Pinkney believed that the ignorance of blacks was due to their “situation, and therefore no evidence of their inferiority" (Jordan, 1974, p. 175). According to Rush, the differences between races was due to “Climate, Country, Degrees of Civilization, form of Government, or other accidental causes"(Jordan, 1974, p.118).

There were many examples of blacks contradicting the stereotypes of inferior intellect. For example, people such as Phyllis Wheatley, Thomas Fuller, and Benjamin Banneker shattered these stereotypes. After publishing a number of poems at age 17, “Phyllis Wheatley, 'the negro

poetess,' became antislavery's most prized exhibit, her name virtually a household term for the Negroes mental equality"(Jordan, 1974, p. 117). According to Jordan (1974),

Benjamin Rush, first engaged in anti-slavery controversy in 1773, was responsible for bringing to light the strange case of Thomas Fuller, a Maryland Negro who perfectly embodied the hopeful proposition that a slave might demonstrate great natural talent despite his slavery. ... Overnight he became an antislavery hero, often referred to simply as 'the Negro mathematician'. (p. 176)

Thomas Fuller helped shine some doubt on the assumption that slave or blacks were inferior intellectual or that their lack of intellect was due to their situation in life. In addition, "something of a mathematician, ...Benjamin Banneker, an Ethiopian whose abilities as surveyor and astronomer already prove that Mr. Jefferson's concluding that that race of men were void of mental endowment was without foundation" (Jordan, 1974, p. 176).

Characteristics of Race

Many believe that a person's race is associated with a set of innate characteristics. Skin color was one of these innate characteristics that separated people by race therefore the search was on to try to explain why people had different colored skin. Many argued that "the cause of blackness was explained in Scripture" (Jordan, 1974, p. 22). From the beginning, many had considered the environment an explanation for a person's skin color. This idea must have really taken hold because in 1911 Franz Boas in *The mind of primitive man* was still arguing that environmental factors was the reason for the differences between races. Benjamin Rush, a founding father and medical doctor, believed that the "Black Color of the Negroes Is Derived from the Leprosy" (Jordan, 1974, p. 201). Therefore since leprosy was a disease if we could figure out how to cure it we could cure black men of their color.

However, if we consider everyone is born *tabla Rasa*, then no one is born with innate characteristics. Nonetheless, there have been many different characteristics used to describe people from all walks of life with most of these characteristics revolving around derogatory remarks such as lazy, idle, stupid, ignorant, inferior, nasty, or immoral, used to humiliate or to build popular support for injustice. For example, according to Weatherford,

Kant, in his 1772 lectures on philosophical anthropology at the University of Königsberg, characterized American Indians as lazy, uncivilized, and “incapable of civilization. ... In a note in his lecture he foreshadowed two long centuries of racist thought in Germany. ... [by describing Indians as being] incapable of governing themselves [and] destined for extermination. (1988, p. 127)

Rush was a firm believer in fundamental equality nevertheless he “contributed to views of race and racial inferiority in the early period of the nation” (Watkins, 2001, p. 28) by characterizing American Indians as unclean, nasty, idle, intemperate, stupid, and indecent savages.

According to Anderson, African-Americans have been characterized as “childish, thriftless, careless, shiftless, and idle by disposition” (1988, p. 92). However, these are some the same characteristics used to describe Native Americans. Nevertheless, well known people throughout our history have had an enormous influence on the construction and reinforcement of the public's perception concerning the many characteristics of race and have used this influence to create stereotypes of the poor, Native Americans, African Americans, and others considered different. Many of these characteristics have functioned to make legitimate the injustice that is carried out on people considered inferior or different and have been used to justify atrocities such as slavery and the genocide of Native Americans as well as keep the American psyche intact from the guilt of our past.

What is racism and where did it come from?

These classifications of race functioned to create a means to control and oppress and eventually evolved into what we now call racism. For example, racism is a rationalization for prejudice, discrimination, exploitation, cultural intolerance, brutality, and control based solely on a person's race, skin color, ethnic background, gender, or cultural differences. Racism is nothing new in the United States, in fact, according to Spring it was "part of the cultural baggage English colonists brought to North America" (2004, p. 6). For example, the British Anglo-Saxons believed that they were superior to all other races and used this philosophy to rationalize and justify their brutal conquests of others who they considered inferior, and did it all using a moral argument. "Racism is as much a part of this country as the U.S. flag. ... This country was built on racism, from the stolen lands of the Native Americans to the stolen wages of African slaves" (Gutstein, 2006, p. 131). Therefore, historically racism has been used to oppress and control Native Americans, African Americans, and many others not considered Anglo-Saxon.

Using Science to legitimize racism.

However, as with punishment, described by Foucault in *Discipline and punish* (1995), the masses have become sensitive to the issues of racism, prejudice, and discrimination. Therefore in order to perpetuate these issues the masses needed to be convinced that they were morally justified in carrying out all of their heinous acts of exploitation and discrimination based on someone's race. Using the moral argument in association with the power and authority of science, people were convinced that discrimination and prejudice against certain races, ethnic groups, and women was the natural order of things. For example, one of the biggest questions that we have faced throughout our history is: Are we who we are because of nature or nurture,

genetics or the environment? Is academic ability which includes math ability, genetic, or is it a product of the environment? My personal view is that we are definitely products of our environment and since math is a human construct, math ability has more to do with the environment. However, for many years pseudo-science or what Jacoby (2009) and Paulos (2001) call junk science have perpetuated the claim that it was strictly genetic and these ideas articulated with the classifications of race functioned to legitimize the oppression, exploitation, and discrimination of certain groups of people. But where did these ideas originate?

Darwinism

In 1859 Charles Darwin introduced his book *On the Origin of Species* and Darwinism was born. *The American Heritage Dictionary of the English Language* (2000), defines Darwinism as “a theory of biological evolution developed by Charles Darwin and others, stating that all species of organisms arise and develop through the natural selection of small, inherited variations that increase the individual's ability to compete, survive, and reproduce.” Darwin’s book was very influential in convincing the masses that life was all about survival of the fittest. Although according to Adam Rutherford in *Why Racism Is Not Backed By Science* (2015), “Darwin was not a racist,” some of his theories have morphed into economic, political, and social theories that give legitimacy to racism and sexism on a grand scale. For instance, some of theories have created the perception that evolution governs everything including society. Therefore if a person was poor, it was because of her/his inferiority and not because of other social, cultural, or economic forces. These theories provided a biological justification for why some people are successful and others are not by describing unsuccessful people as inferior in some way. Since life was survival of the fittest, those considered superior would rise to the top, while the inferior groups of people were destined to remain bottom dwellers.

Social Darwinism

As Darwinism began to gain some credibility in the scientific community, many theories and ideologies used Darwinism as a platform. One such theory, Social Darwinism, is “a 19th-century theory, inspired by Darwinism, by which the social order is accounted as the product of natural selection of those persons best suited to existing living conditions” (Dictionary.com).

Although inspired by Charles Darwin and Darwinism, Darwin was not a social Darwinist.

Herbert Spencer, considered by many to be the father of Social Darwinism, believed that people gained power because they were better able to adapt to the environment. For example, Social Darwinism considered certain races genetically superior to others and applied the biological concepts of Darwinism or evolution to explain sociology and politics. These theories contend that people in society follow the same Darwinian laws of natural selection as every other species of organism on the planet. Therefore survival of the fittest is a part of everyday life, not just in a biological sense, but also in the social and economic sense. According to Franklin H. Giddings “capitalism was nature’s purest form of economy. Competition, for him, was consistent with evolutionary struggle” (Watkins, 2001, p. 70).

Social Darwinism functioned to explain why some people are more successful than others by creating the perception that some people are rich and some people are poor because that is the natural order of things, and not on the many other lurking variables that could influence such success or failure. For example, Social Darwinists attribute “poverty to inadequate self-esteem, ambition, and character” (Watkins, 2001, p. 17) and failed to criticize the social and economic system. There is not really anything that a person can do, because we were all controlled by natural selection. It was just the luck of the draw that determined what race or gender a person would be, or if they would be wealthy or poor. If you are lucky, you were born to a superior

family, because the strongest and fittest would survive and flourish in society while those considered unfit would just fade away like the Neanderthal. According to Watkins, our cultural views of how the “fit survive and prosper, while idlers, feebleminded, and ne’er-do-wells struggle and suffer [are the] Puritan and Social Darwinist contributions to the American culture” (2001, p. 84).

Eugenics movement

One of the major movements to come out of Social Darwinism that has played a tremendous role in constructing and reinforcing many of our social and cultural attitudes and perceptions concerning race, gender, and social class is the eugenics movement. According to Watkins, “the eugenics movement began in Europe in the mid-nineteenth century with the theorizing of Sir Francis Galton, [and] became another building block in the platform of 'scientific' racism” (2001, p. 35). The eugenics movement articulated with social Darwinism is responsible for the many myths and stereotypes created throughout our history that reinforce the idea that most minorities including women, African-Americans, and Native Americans possess little or no innate ability to learn anything, much less to perform simple mathematical tasks and was “inspired and validated by the scientific consensus that blacks were inferior to whites” (Egnor, 2015).

For example, David Jardine suggests, the eugenics movement has been responsible for many of the social issues concerning race, because the eugenicists underwrote the majority of “racial theories earlier this century” (2006, p. 45). These theories were reinforced by scholars of the time who insisted that they had definitive proof of the inferiority of Native Americans and African-Americans. For example, according to Jacoby (2008), Alexander Winchell former president of Vanderbilt University, believed

that Darwin's theory of natural selection actually proved the inferiority of the Negro race. ...[and because of his] academic success as a eugenicist evolutionist, and the respect in which he was hailed by most of the scientific community, illustrates the utility of social Darwinism in blurring the distinction between real science and pseudoscience. (p. 68)

The medical profession at the time helped to promote and reinforce these stereotypes and received funding from various corporate foundations for the purpose of discouraging people considered inferior or who possess genetic defects from producing offspring.

Since blacks were considered inferior and defective in some way, there was a push by the public for selective breeding and sterilization. What is totally amazing is that some states went as far as formulating and passing sterilization laws. The eugenics movement used science to rationalize labeling African-Americans inferior thereby providing justification for the exploitation of people of color (Watkins, 2001, p. 35). The eugenicists associated social mobility with genetic makeup and used this argument as an explanation of why some people are rich and some are poor and not on sedimented inequality or discriminatory forces, or the many other lurking variables that could influence such success or failure. The eugenics movement and many other movements throughout history have helped to reinforce these perceptions of which some of these perceptions are still very prevalent today. These movements have had a profound impact on education in the United States and therefore must be acknowledged. According to Jacoby (2008), "the combination of eugenics and social Darwinism enabled proponents to validate the worthiness not only of individuals but of groups" (p. 68).

Phrenology

With the articulation of the eugenics movement and Faculty Psychology, a new form of pseudoscience was born that compared cranial capacity with intelligence or the ability to learn.

This new science called Phrenology considered the mind to be a muscle and that the people with bigger brain sizes were considered the smartest. This science was carried out by measuring the skull cavities of people of different races and genders with the measurement sometimes consisting of counting the number of marbles the brain cavity could hold. The brain cavities that held the most marbles were considered to be the most intelligent. As silly as this seems today, back then it was considered cutting edge science. These forms of junk science when connected to Darwinism would form the scientific justification for injustice on a wide scale. These movements should serve as examples for why people should become educated enough to read through the misinformation and propaganda prescribed by junk sciences such as the eugenics movement. The problem is that although many of these theories have been debunked, they have been so firmly embedded in our culture that they are extremely difficult to eradicate.

The articulation of Darwinism and the eugenics movement provided biological justifications for racial discrimination which “had a particular appeal, covert and overt, in a nation that had long enslaved a large population of a different race and had done little since the end of slavery to ameliorate the damage inflicted on that minority” (Jacoby, 2008, p. 68). It is now easy to look back through history and see the impact of Darwinism, Social Darwinism, the eugenics movement, and phrenology in justifying everything from Racism to Sexism, Colonialism to Imperialism, and Fascism to Nazism. We have seen these views justify the murder and attempted genocide of the Native Americans and were later used by the Nazis’ to justify genocide and murder like the world has never seen. All of this history gives me reason for concern. However, when looking back it is easy to see where the postmodern concern over grand narratives originated when it comes to science. For example, although today social Darwinism has been proven to be false there are still many who believe these assertions as fact. However,

this is understandable when we consider how the ideas of social Darwinism have been historically, socially, and culturally constructed and remain an integral part of our social and cultural DNA.

What does racism have to do with education?

According to Watkins in *The White Architects of Black Education*, “education would become an important force in the conscious society. Education could unleash the intellect for some, and train others. Education could serve the purposes of both enlightenment and control. Both would be necessary in the democratic empire” (2001, p. 77). However, historically educational policies have enlightened the few and controlled the many, and when it comes to race, “economic exploitation [has always been] central to the educational policies for Native Americans and African Americans” (Spring, 2004, p. 2). It was extremely important that these groups of people remained uneducated, discouraged from learning, or at the very least controlled by some hidden curriculum in order to oppress and exploit. The people in power, and who wish to control others, understand the power of education to empower and liberate. However, they need a large workforce of low skilled, uneducated, and low paid workers and get this workforce by restricting access to education.

Although having an educated and informed populace is vital to the survival of a democracy, many believe that certain races are incapable of learning. For example, a central premise of the eugenicists was that American institutions were incapable of molding or assimilating the “‘inferior’ races (Haller, 1984)” (Watkins, 2001, p. 37). This helped create and reinforce the perception that it was a waste of time and money to invest in educating someone considered inferior such as the poor, Native Americans, and African Americans. For example, the culturally and socially constructed perceptions of blacks as intellectually inferior, was one of

the reasons why “many people were against public education for blacks” (Watkins, 2001, p. 117). Furthermore, there was little reason to provide decent public education for poor whites, much less blacks” (Jacoby, 2008, p. 53). Since it was believed that minorities or anyone else considered inferior could never learn, many were never given the opportunity. The views and perceptions constructed and reinforced by the eugenics movement articulated with Social Darwinism still have an influence on our culture and society and are responsible for many of the social problems that exist in the United States today.

Native Americans

What does racism have to do with Native American education? According to Spring, the early English considered Native Americans as racially inferior, savages, pagans, and degenerates and quickly turned “cultural differences into racial differences” (2004, p.1). The public perception of Native Americans however was far from reality. Nevertheless, these socially and culturally constructed perceptions functioned to legitimize and justify taking the land in which Native Americans had lived for many generations, discrimination, persecution, and acts of genocide. In addition to labels of inferiority, these views and perceptions gave the settlers of the new world a valid reason for injustice on a grand scale. These social and cultural views had such an impact that according to Watkins, “American Indians were viewed as barbaric and immoral and even Hampton’s Blacks were convinced that the Native Americans were lower on the social ladder than themselves” (2001, p. 51). Because Native Americans had different cultural values, gender roles, and economic relationships than most of the population, it was easy to use these differences as a means of control. For example, “when English colonists, and later educators and officials of the U.S. government, considered deculturalization of Native Americans, they included replacing cultural values related to family structures, gender roles, child-rearing

practices, sexual attitudes, economic relationships, and the government” (Spring, 2004, p. 8).

A couple of differences, according to Spring, had to do with “the importance of hard work and the accumulation of property” (2004, p. 9). In contrast, the Indians believed in play, and did not believe that a person could own property because the land should be for everyone to use equally. For gender roles, the English believed that men were superior to women and this belief controlled most aspects of daily life. For example, the English believed in the idea of the patriarchy; however, the Indians were considered a matriarchal society. The women of the tribe were the only people who were allowed to vote and make decisions for the people. For example, the women elected the chiefs and allocated what work needed to be done in considering the tribes best interest. The women decided on how people captured in battle were to be treated, as new members of the tribe, slaves, or tortured and killed. This was in total contrast with the English or Protestant way.

When it comes to education the English believed in “discipline, authority, and memorization” (Spring, 2004, p. 9). Many Native Americans didn’t consider memorization because to them everything is in a state of flux (Moschkovich & Nelson-Barber, 2009, p. 119). The English had school in a classroom. However,

the education of Native American children did not take place in the formal setting of a ‘school,’ but was integrated into the community life of the tribe. The storytelling of elders, the working with adults, the participation in tribal ceremonies and puberty rites, and the customs of the clan and tribe educated Native American children for tribal life. (Spring, 2004, p. 9)

Although the public perception of the Indians was as barbaric savages who were unable to learn, they were in reality very proficient in terms of ability. The characterization of Native Americans

given by Kant as well as the characterizations of African-Americans created by the social Darwinists and the eugenicists worked to formulate stereotypes that had no basis in reality.

For example, if Native Americans had no ability to function mathematically, then how did they develop their own type of Cartesian coordinate system? For example, the Navajo belief in "the four winds, ...[and] the patterning of drumbeats in groups of four during ceremonies" (Eglash, 2009, p. 282). In addition,

the Chickasaw pipe ceremony ...makes use of the four cardinal directions, and then maps various concepts to these axes: North includes winter, struggle, and conflict; South includes summer, freedom, and respect. He calls this the 'six direct sense' organizing principle – six because in addition to the four kernel directions there is also below (earth) and above (spirit). (Eglash, 2009, p. 285)

These examples show the Native Americans as more advanced in mathematical thought than any of the perceptions of them appeared.

Furthermore, if Native Americans had no innate ability to learn, then how did Sequoia's school graduate all students 100% literate? A task that today is unmatched by any of the schools in the United States, yet they were labeled as racially inferior. The U.S. government considered Native American schools so inferior that the moral thing to do would be to take control. Many of the schools operated by the U.S. Army and designed specifically for the Native American population were done so because of cultural intolerance. One of the most famous of these off-reservation boarding schools, the Carlisle Indian Industrial School, was established in Carlisle, Pennsylvania in 1879 with the help of Col. Richard Henry Pratt for the purpose of figuratively killing the Indian to save the man (Landis, 2006). For example according to Swetz, "such schools were intended to deculturize the Indians and turn them into *useful* citizens" (2009, p. 31).

Therefore, the use of white education for Native Americans was nothing more than a way to control and oppress the Native Americans and their culture.

African Americans

Slavery and Slave Education

Slavery in America started “because there were economic necessities ... which called for some sort of bound, controlled labor” (Jordan, 1974, p. 34). Although some people were indentured servants and were free after they had worked off their debt, many Native Americans and Africans were considered prime prospects to be put into slavery for life. “At the start of English settlement in America, no one had in mind to establish the institution of Negro slavery. Yet in less than a century the foundations of a peculiar institution had been laid” (Jordan, 1974, p. 26). Native Americans had too many practical problems when they were kept as slaves. They could just run away back to their home. However, Africans could never run away because most had no means to get back to Africa. In addition, “the Negro was readily identifiable as such; he was born branded” (Jordan, 1974, p. 61). “Slavery could survive *only* if the Negro were a man set apart; he simply had to be different if slavery was to exist at all” (Jordan, 1974, p. 89).

During the era of slavery, although African Americans and African culture were labeled inferior, it was illegal to teach slaves to read and write throughout the Western Hemisphere and in some places slaves could be put to death for attempting to learn. Around 1750, the vast majority of blacks, slave and free, grew old and died with no education at all. What little schooling was available to blacks came by way of the churches” (Jordan, 1974, p. 67). According to Jacoby (2008), many plantation owners were “certain that Negroes were too weak-brained to learn to read (not weak brained enough, though, for southerners to feel comfortable unless they pass laws prohibiting the teaching of reading to slaves” (p. 239). However, many slaves saw

learning to read and write as a means of liberation and many times would seek a spelling book instead of food. For example, Blacks wanted to be educated, in many cases, more than life itself and would attempt to hold secret classes no matter the cost. These slaves “viewed literacy and formal education as a means to liberation and freedom” (Anderson, 1988, p.17).

According to Anderson (1988), “planters, however, favored a policy of strict labor control and discouraged the education” (p. 21) of all blacks including free blacks. When it came to educating slaves,

slave masters gave a great deal of attention to the education and training of the ideal slave. In general, there were five steps in molding the character of such a slave: strict discipline, a sense of his own inferiority, belief in the master's superior power, acceptance of the master's standards, and, finally, a deep sense of his own helplessness and dependence. At every point this education was built on the belief in white superiority and black inferiority. Besides teaching the slave to despise his own history and culture, the master strove to inculcate his own value system into the African's outlook. The white man's belief in the African's inferiority paralleled African self hate. (Coombs, 1972)

However, slaves and free blacks set up their own schools, even in places where schools were illegal and had to operate underground, and because of this many were able to read and write.

After Slavery

After the end of slavery, the freed slaves had many compelling reasons for getting an education, many revolving around empowerment and liberation. Education would give people the power to understand many of the transactions and contracts of daily life and not be cheated. For example, according to Anderson (1988), “the uses and abuses of written labor contracts made it worthwhile to be able to read, write, and cipher. Frequently, planters designed labor

contracts in ways that would confuse and entrap ex-slaves” (p. 18). These “newly freed people sought to develop reading and numeracy skills so as not to be cheated in contracts and transactions with former slave owners and other Whites” (Martin & McGee, 2009, p. 217). This is still relevant today because most people, regardless of race or gender don’t have the basic math skills and level of numeracy necessary to understand basic activities, transactions, or contracts involving numbers and therefore can be easily manipulated. The ex-slaves understood the importance of education in giving people the ability to critically analyze many types of situations and avoid being cheated or exploited.

The strong desire to learn how to read, write, and do arithmetic brought about an increase in the number of black schools. “In Savannah, for instance, there were 28 schools in 1866, and 16 of them, reported the black *Loyal Georgian*, were 'under the control of an Educational Board of Colored Men, taught by colored teachers, and sustained by the freed people'”(Anderson, 1988, p.11). The leaders of the black education movement would use a classical curriculum as a model for their schools. For example, elementary and Normal school students “received instruction in reading, spelling, writing, grammar, diction, history, geography, arithmetic, and music; ...[the Normal or High School students took] additional courses in orthography, map drawing, physiology, algebra, and geometry, as well as the theory and practice of teaching” (Anderson, 1988, p. 28).

Although there were many Black schools, most of the newly freed people were never educated. Using evidence provided by the theories of Social Darwinism and the eugenics movement, people of the South looked at Blacks as inferior and this played a huge role in race relations and education. In the 1890s, many Southern states enacted Jim Crow laws used to enforce racial segregation in schools because according to Egnor (2015) “segregation and

eugenics were inspired and validated by the scientific consensus that blacks were inferior to whites and that integration was scientifically unwise and even catastrophic.” According to Anderson, it is here that we can see a move towards an “ideological hegemony in 1898” (1988, p. 83). Post-Civil War race relations in the South were best described by what Watkins calls “accommodationism ...[that dictated] Blacks accept the world the way it was. Existing race relations were simply part of the natural order” (2001, p. 23). Because of these views, “most white Southerners, therefore, were naturally suspicious of the philanthropists claim that blacks could be formerly schooled to accept subordinate social and economic roles” (Anderson, 1988, p. 99).

After noticing some success in these black schools, many wealthy whites were concerned that if the freed slaves were to become educated, thereby giving them the power to liberate themselves, and collectively join forces with many of the poor whites it would be disastrous for cheap labor and the status quo. Therefore, the philanthropists attempted to create an atmosphere to “conform to and reinforce values of the dominant order” (Watkins, 2001, p.18). “The philanthropists needed to propagate and reinforce a social ideology favorable to the corporate capitalist economy and culture” (Watkins, 2001, p. 21). For example, “philanthropist George Peabody endeavored to convince his southern countrymen that the Hampton-Tuskegee program could help build a strong southern economy on the backs of submissive, nonpolitical, cheap black laborers” (Anderson, 1988, p. 89). Even though there had been many changes since the end of slavery, the rich have always used the backs of the poor to produce their wealth and they understand the importance of using education to control and maintain the status quo. Although slavery ended many years ago, there are still some who seek out new methods of controlling labor.

Therefore, these white philanthropists donated money to start up many of the Black schools and colleges, not out of the goodness of their hearts or for some humanitarian effort but as a way to ensure control. For instance, they did provide money to start these schools but they also controlled the curriculum of which was mainly agriculture or servitude. For example, blacks could go to school to learn how to work in the fields or to become a maid or butler. They “also taught manual skills at a time when machinery and mass production were clearly the wave of the future” (Watkins, 2001, p. 134). “Many black intellectuals and leaders recognized that the Hampton-Tuskegee program was essentially an educational blueprint for black subordination” (Anderson, 1988, p. 102).

The objectives of many of these philanthropists were “a thoroughly re-annexed and orderly South, the expansion of public schooling for all, the maintenance of cheap Black labor, and the continuation of Black subservience and segregation” (Watkins, 2001, p. 134).

This would be carried out by Samuel Chapman Armstrong’s philosophy of ‘Black Reconstruction,’ widely publicized as the ‘Hampton Idea,’ [that] called for the effective removal of black voters and politicians from southern political life, the relegation of black workers to the lowest forms of labor in the southern economy, and the establishment of a general southern racial hierarchy. (Anderson, 1988, p.36)

However, this type of social arrangement would be met with great resistance and therefore needed a middleman whose work would be to convince many Blacks to accept this arrangement. This would be carried out by “indigenous black educators” (Anderson, 1988, p.36). Armstrong would use his most decorated student Booker T. Washington, a former slave, to convince the black population that this type of education would benefit the Black population. Although many people believed that Booker T. Washington sold out the Black population by making agreements

with the wealthy philanthropists, it seems that maybe he was in fact a visionary because today these schools have become leading schools of higher learning for African Americans. Without his actions most of these schools would have never been constructed. Nevertheless, although many things have changed, US education still pushes the Hampton Idea.

After the Civil Rights Movement

At around the turn of the 20th century many white kids attended schools that were funded by the public; however, no one wanted to pay to educate any black kids. Anderson (1988) posits “the most oppressive feature of black secondary education was that southern local and state governments, though maintaining and expanding the benefits of public secondary education for white children, refused to provide public high school facilities for black children” (p. 186). “For blacks, the public school systems of the South rarely provided any education beyond eighth grade until well into the twentieth century” (Jacoby, 2008, p. 53). Although people knew that Blacks would need to be educated if they were to become useful citizens, they still did not want to pay for it because many believed the myths that black children were incapable of learning. According to Anderson, this issue was debated at great length and in 1901 the president of the University of Tennessee Charles W. Dabney argued that “the only solution of the southern problem is free public schools for all the people, blacks and whites alike, and compulsory-attendance laws. He spoke strongly for universal education for black children” (1988, p. 85). However his concern was not based on moral grounds but on the influence that all of these uneducated people would have on the destruction of society. For instance, he states “the negro is in the South to stay-he is a necessity for southern industries-and southern people must educate and so elevate him or he will drag them down” (Anderson, 1988, p. 85). Although many states passed school compulsory laws, many did not. For example, "Georgia did not pass its

compulsory school attendance bill until 1916, and it still allowed local school boards to exempt black children from the law” (Anderson, 1988, p. 101).

Ever since the civil rights movement, African Americans have gained some power in terms of education and this has worked to improve their social and economic standing significantly. We have seen a huge increase in the numbers of African Americans considered middle class and many have worked hard to gain access to higher education, some reaching the highest ranks of government. However, because of this “many Americans ...believe that barriers like racism no longer exist for African Americans in the post-civil rights era” (Martin & McGee, 2009, p. 210). Nevertheless “since the end of legal segregation, boosterism about the 'New South' has obscured the fact that the Old South still lives on in many public school systems that fail to serve either blacks or poor whites” (Jacoby, 2008, p. 189). “Although no longer restrained by overt Jim Crow and racist practices of earlier decades, African-Americans of all backgrounds continue to confront barriers to their educational, economic, and political progress” (Martin & McGee, 2009, p. 210).

For example, when it comes to education, there is still a historical element of racism working to keep African Americans and other races considered inferior to the dominant ideology subservient and oppressed. One way to do this is to keep the people considered inferior from acquiring the education necessary for liberation or empowerment. We have seen how historically white Americans have controlled black education. However, it doesn't seem whites have done a good job because according to Fordham and Ogbu (1986), "black Americans traditionally have been provided with substandard schooling, based on white Americans' perceptions of the educational needs of black Americans” (p.178). Therefore, it makes sense that “the low school performance of black children stems from white people [providing] them with inferior

schooling and [treating] them differently in school" (Fordham and Ogbu, 1986, p.179). If we were to just consider a small portion of the history of black education in the United States, it is hard to deny the claim of inferior schooling. Nevertheless, as Blacks gain more and more power socially and economically, there is a need to find a way to restrict access to many of them and make them think it is their fault. This could be carried out by combining inferior schooling with standardized tests. Through the use of these tests, education could once again be used as a form of slavery by controlling access to the knowledge and skills needed to survive and prosper in society.

Today

Today, most African Americans have better access to education, and although some find great success, many do not. The question is why? Could it be because of the historically, culturally, and socially constructed messages, conditions, and experiences, that convince many at some level to resist or avoid learning? After all of the ways that education has been used historically, African Americans, Native Americans, and most minorities have a good reason for viewing education as a tool of the white man used to oppress. However, this resistance to education seriously impacts who they, and we, may become and only functions to reproduce the status quo. For example, in McWhorter's *Losing the Race: Self-Sabotage in Black America*, he talks about how the label of acting "white" is used as a means of resistance for black males, and how this resistance seriously impacts their education. Some of my black students have told me that if they do well in school other black students will label them as acting "white." According to Signithia Fordham and John Ogbu (1986), the idea of 'acting white' seriously impacts the education of most black Americans. For example, they suggest that "some segments of the black community [have developed] a kind of cultural orientation which defines academic learning in

school as 'acting white,' and academic success as the prerogative of white Americans" (p. 177).

Acting white is a "socially or culturally approved strategy for getting ahead within a given population or a given society" (Fordham and Ogbu, 1986, p.179). However for many "their main strategy for coping with the burden of acting white tends, ...to be *avoidance*"(Fordham and Ogbu, 1986, p. 187). All of these ideas are responsible for much of the low academic performance of black Americans and some minorities.

There are many reasons why people resist acting white. For example, people resist acting white because of the social pressure against academic success put on an individual by the individual themselves, as well as parents, peers, and other members of the community. People who are good at mathematics but are part of a social group against academic success may feel as though their ability tempts them to cross cultural boundaries that will result in betraying or letting down their group. Fictive kinship is another reason why minority groups resist the idea of becoming educated as a show of group solidarity and loyalty. For example, because of their fictive kinship, "black Americans ...[tend] to emphasize *group loyalty* in situations involving conflict or competition with whites. ...Black children learn the meaning of fictive kinship from their parents and peers while they are growing up" (Fordham and Ogbu, 1986, p. 185). Another reason why people may resist acting white is because of "opposition from their peers and probably from other members of the minority community" (Fordham and Ogbu, 1986, p. 182). Since learning is seen as siding with whites, most black Americans pressure their peers not to do well academically. For example, these "individuals "resist" striving to do well academically partly out of fear of peer responses and partly ...because they also share their group's sense of collective identity and cultural frame of reference, individuals may not want to behave in a manner they themselves define as "acting white." (Fordham and Ogbu, 1986, p. 183). Students who want to

do well in school and still remain popular or part of the social group often attempt to hide their success. For instance, a person can avoid being ostracized for being considered smart if they are athletes, comedians, or are just blessed with natural talent. If you were considered smart, your manhood could be in question. When it comes to school and learning, people who want to do well struggle with “the immediate issue ...[of] how to obtain good grades and meet the expectations of school authorities without being rejected by peers for acting white” (Fordham and Ogbu, 1986, p. 198).

Many times acting white is a result of the anxiety or fear of striving for academic success. For example, the fear of striving for academic success is understandable when we consider our history. For example, we have seen the impact of Thomas Jefferson and many others proclaiming the inferiority of black Americans and these thoughts are still very prevalent today. Although today we know that this is not true, these ideas have been deeply engrained in the American psyche and are extremely difficult to eradicate. After being told over and over again about their inferiority, "black Americans subsequently began to doubt their own intellectual ability" (Fordham and Ogbu, 1986, p. 177). When a person is constantly reminded of their inferiority, it doesn't take long before they may start to believe it. Once they believe they are inferior, the doubt of success may convince them to never try. Because failure is inevitable, what is the use in trying? However, as a means of dealing with this doubt, black Americans “began to define academic success as white people's prerogative, and began to discourage their peers, perhaps unconsciously, from emulating white people in academic striving, i.e., from 'acting white'" (Fordham and Ogbu, 1986, p. 177). The problem is many of these coping mechanisms may “further limit [a person's] striving for academic success” (Fordham and Ogbu, 1986, p.179) as well as a person's desire to learn.

According to Fordham and Ogbu (1986), “acting white” is the result of an oppositional

social identity and cultural frame of reference which includes devices for protecting their identity and for maintaining boundaries between them and white Americans” (p. 181). Anything perceived as white becomes an object of opposition and is viewed very negatively. “The cultural frame of reference of subordinate minorities is emotionally charged because it is closely tied to their sense of collective identity and security” (Fordham and Ogbu, 1986, p. 181). Since success in school or mathematics is considered acting white, “school learning is therefore consciously or unconsciously perceived *as a subtractive process*: a minority person who learns successfully in school or who follows the standard practices of the school is perceived as becoming acculturated into the white American cultural frame of reference at the expense of the minorities' cultural frame of reference and collective welfare” (Fordham and Ogbu, 1986, p. 182). The perception of schooling as a subtractive process causes subordinate minorities to "oppose" or "resist" academic striving; both socially and psychologically" (Fordham and Ogbu, 1986, p. 183). However, if one were to consider the power that the whites have had in creating and controlling black education, then these views seem quite reasonable. The white control of black education hasn't worked in making sure each and every person is well educated, on the contrary, it has worked to create a culture that has stifled the desire for education. “The burden of acting white becomes heavier when academically able black students face both pressures from blacks peers to conform, and doubts from whites about their ability” (Fordham and Ogbu, 1986, p. 199).

So what can be done so that minorities can get past these issues and stop being harassed or feeling guilty for seeking out an education? Fordham and Ogbu (1986) warn us that “barring changes in the opportunity structure, the perceptions, behaviors, and academic effort of black adolescents [we] are unlikely to change to the extent necessary to have a significant

effect on the existing boundary-maintaining mechanisms in the community” (p. 202). In addition they suggest that “students learn to divorce academic pursuit from the idea of acting white” (Fordham and Ogbu, 1986, p. 203). However they argue that the black community must help change our current situation by developing

programs to teach black children that academic pursuit is not synonymous with one-way acculturation into a white cultural frame of reference or acting white. To do this effectively, however, the black community must reexamine its own perceptions and interpretations of school learning ...[because] apparently, black children's general perception that academic pursuit is "acting white" is learned in the black community. (Fordham and Ogbu, 1986, p. 203)

The only hope is that people awaken and see that this socially constructed lack of desire is another form of control.

For instance, in Henry Louis Gates’ lecture *Mister Jefferson and the trials of Phillis Wheatley* (2002), he talks about how we have moved from a situation where Phillis Wheatley's acts of literacy could be used to demonstrate our people's inherent humanity and their inalienable right to freedom, to a situation where acts of literacy are stigmatized somehow as acts of racial betrayal. Gates also cited an informal poll where African American students in Washington DC were asked what it meant to act white. Two of the major replies were making straight A’s and speaking Standard English. But why and how could these students feel this way when we consider the lengths that many of their ancestors went to in order to get an education? Why today do so many African Americans choose not to learn, but consider education very important? The answer is that they have been historically, culturally, and socially constructed through hegemony, anti-intellectualism, and other environmental factors to feel this way.

Have we seen the end of scientific racism?

Today we have a better understanding of scientific racism and how the concept of race is not a biological entity but a human construct. Nevertheless, scientific racism has been used to justify numerous atrocities such as genocide of the Native Americans, the Nazis extermination of the Jews, South African apartheid, and racial segregation in the United States. In Benjamin Isaac's *The Invention of Racism in Classical Antiquity* (2004), he suggests the roots of scientific racism may be found as far back as the ancient Greeks and Romans. However, according to Michael Egnor (2017) "scientific racism and eugenics were mainstream science — consensus science — from the publication of Darwin's theory to the end of World War II." However, shortly after the end of the war the power of these sciences began to slowly decline and eventually, according to Egnor (2017), was "ended largely by courageous scientists and others (largely religious people who believed in human exceptionalism) who spoke out against the scientific consensus" responsible for the promotion of this junk science.

As technology and medicine advanced and we gained a better understanding of genetics, the Human Genome Project provide further evidence against the scientific racism of the past. According to Rutherford (2015), "we now know that the way we talk about race has no scientific validity. There is no genetic basis that corresponds with any particular group of people, no essentialist DNA for black or white people or anyone." Because of this, Sankar-Gorton (2015) suggests that "most biologists, geneticists, and anthropologists have discarded the concept of race ...because actual genetic studies have shown that ...DNA does not necessarily differ between different groups in any recognizable way. You cannot distinguish any group called a race by their DNA."

However, I have to question if we have actually seen the end of scientific racism. For example, in 1994 psychologist Richard J. Herrnstein and political scientist Charles Murray published the book titled *The Bell Curve: Intelligence and Class Structure in American Life* that discussed the normal distribution of IQ scores in the population. The book was very controversial because it argued that there were racial differences in IQ between African Americans and whites. These differences were used to reinforce many of the ideas and theories connected with scientific racism. However, this is understandable because according to Messer (2014), “racism as a social and scientific concept is reshaped and reborn periodically through the ages and ...both medical and scientific researchers need to be careful that the growth of genomics does not bring about another resurgence of scientific racism.” According to David Freeman (2015), “race is outdated and often pejorative, but racism is alive and (unfortunately) not decreasing. I think we must remain on the alert for racism and have ready responses to it when it rears its ugly head.”

History of Gender, Education, Mathematics, and Science

History of the roles of men and women in society

Many of our current attitudes and perceptions concerning gender are a result of our historically, socially, and culturally constructed views. For example, looking back historically it is easy to see the influence of religious ideology, pseudoscience, and medicine on our current views or norms about gender roles. Many of these views span as far back as human history portraying the man as the breadwinner, the defender, and the companion. According to Emsley, Hitchcock, and Shoemaker,

virtually every aspect of English life between 1674 and 1913 was influenced by gender ...

Long-held views about the particular strengths, weaknesses, and appropriate

responsibilities of each sex shaped everyday lives, patterns of crime, and responses to crime... men were considered the stronger sex and were thought to be aggressive, intelligent, courageous, determined, prone to violence, obstinant, and selfish. Women were considered passive and more governed by feelings and emotions which could help explain why they have a tendency to be ruled by their bodies and their emotions, notably lust, excessive passion, shrewishness, and laziness. (nd)

Although there is no factual proof of a woman's inferiority concerning many of these characteristics, most of these views still have a profound impact on our socially and culturally constructed views concerning the roles and responsibilities of men and women. According to Valerie Walkerdine in *Counting Girls Out* (1998), "most accounts of little girls growing up are accounts of socialization which assume that girls are successfully stereotyped into roles" (p. 54).

Religion

There are many stories throughout all of the religions of the world that create and reinforce a patriarchal norm by convincing everyone that men are physically, mentally, and virtuously superior to women. Most of the characteristics and virtues associated with men and women are a direct result of some religious ideology. It is hard to argue that these religions and most of the stories associated with them have had a long-lasting impact on how we view gender roles, in our culture, as well as many other cultures throughout the world. Religion has been very influential in establishing and maintaining gender roles that are in some cases, very rigid. However, in the U.S. and various other progressive countries various feminist movements have worked to chip away and eliminate these historical, cultural, and social norms that discriminate against women, but their work is far from over because there are still many places in the world where religion is directly or indirectly responsible for the persecution and oppression of women.

For example, in some countries because of religious ideology, it is illegal for women to go to school, attempt to become educated, or even drive a car. In these places, the influence of religion still plays a major role in constructing and reinforcing very rigidly defined gender roles.

Early American History of the roles of men and women in society

The common schools

In early American history, many of the social and cultural norms associated with gender and gender roles were constructed and reinforced by means of religious ideology, the home environment, and the common schools. The common schools taught reading, writing, and arithmetic, and it is here where many of the stereotypes about women and mathematics originated. The influence of Darwinism, social Darwinism, the eugenics movement, phrenology, medicine, and the hidden curriculum have reinforced and encouraged people to believe that women are inferior to men and do not have the innate ability to do mathematics. Therefore, most girls with the ability to learn and excel in mathematics were never taught mathematics beyond the basics needed to perform the household duties that were considered the social and cultural norm. According to Walkerdine (1998), teachers are also responsible for exacerbating the problem "by responding to boys and girls in different ways, seeing girls' poor performance as do to lack of ability and boys' to lack of effort" (p. 21). Therefore creating a learned helplessness among the girls.

The hidden curriculum functioned very well at controlling a girls desire to study mathematics. Even girls who wanted to study mathematics were convinced to pursue other more feminine interests. For example, the hidden curriculum taught girls skills considered feminine and males all of the skills considered manly. In the Dick and Jane reader, Dick took part in activities that where boyish or manly and Jane did all of the things a female of the time was

expected to do. According to Walkerdine (1998), mathematics textbooks are also sexist in nature and suggests

clearly these texts do attempt to provide sites for identification, but the subject positions they produce consistently present the feminine as marginal, passive, domestic and failing even at the most trivial activities – partly incompetent. By contrast, the masculine is presented as serious and clever; mastery over the physical and scientific world is assured.
(p.158)

Not only do these texts reproduce gender relations, they also reproduce race and class relations, and we can still feel the power and influence of those texts today.

The influence of myths, stereotypes, and junk science on gender roles

Boy Brain versus Girl Brain

There have been many myths, stereotypes, and stories that reinforce and construct cultural and social attitudes concerning mathematics that have a serious impact on a person's desire to learn. Today many of these myths, stereotypes, and stories use the power of science to support their claims. Although the science they use lacks a certain degree of validity it nevertheless convinces the masses of their claims. For example, according to Jacoby (2008) "the 'boy brain, girl brain' experiments are a more complicated case of junk thought, because they are based on theories of education that do have some relationship to facts, beginning with obvious hormonal and anatomical differences between the sexes" (p. 214). Jacoby posits "such beliefs are directly descended from the unscientific and anti-scientific assumptions of the past" (2008, p. 239). As a mathematics educator, I have seen no difference in mathematical ability and aptitude in terms of gender. However, there are many environmental differences that function to control and shape our perspectives in terms of mathematics and gender. For example, Dane Clausson in

Anti-intellectualism in American Media: Magazines and Higher Education (2003) talks about how throughout the 50s, 60s, and 70s, major journals produced article after article, and conducted interview after interview with very prominent individuals in society that worked to convince women not to seek a college education. For example, Lawrence Summers, former Treasury Secretary under the Clinton administration, president of Harvard and chief economic advisor to the Obama administration "suggested that the low representation of women at the highest levels of science was probably attributable to innate gender differences in scientific and mathematical aptitude" (Jacoby, 2008, p. 232).

Math is a male oriented subject

Another myth concerning mathematics and gender creates the perception that math is a white male dominated topic. But why? Early on in American history, only a very small percentage of people had knowledge of, and could perform, what is considered advanced mathematics. Although this small percentage was predominantly white males, there were many other white males who had little or no mathematical ability beyond basic mathematics like counting or measuring. According to Tobias, one of the common myths that reinforce gender inequality when it comes to math education is that "mathematics is a male domain" (1993, p.12). Walkerdine (1998) argues that "we have socialized "children into defining Mathematics is a masculine field" (p.152). This is understandable when we consider the way our culture and society have shaped our views about the characteristics and abilities of men and women. For example, science, medicine, and the hidden curriculum have functioned to construct, reinforce, and make legitimate many of the stereotypes and perceptions about the ability of men, women, and minorities when it comes to learning mathematics. It was believed that women and minorities were inferior, therefore mathematics would be beyond their intellectual capabilities

and because of this many were never taught anything considered advanced mathematics.

Women can't do math.

Although today many women have access to mathematics and could be very successful at math, the influence of our historical, cultural, and social attitudes concerning gender and education still create the perception and convince people that women just can't do math. Also, our cultural and social views of math as a hard, strict, and rigorous subject, which in many cases is difficult for men, creates the perception that math is too hard for women, because they are too soft and lack the intellect needed to learn mathematics. These views are constructed and reinforced very early in a girl's life. For example, according to Appelbaum, Mattel, in 1992, produced and sold a talking Barbie doll which when activated says over and over that "math is hard" (1995, p. 170). How many girl's mathematical identities were impacted by their experiences with this toy? How many are impacted by the rhetoric telling us women are inferior to the point where our culture and society accept their lack of mathematical aptitude as the norm? Norms that are a result of the powerful influence of the eugenics movement and social Darwinism that are still very influential today. On the contrary, women are capable of learning anything they wish. Some have very good math skills already and just don't know it.

Can't do math but I can shop.

For example, one day I decided to go shopping for a couple of new shirts, a pair of pants, and some shoes. On the way I ran into a couple of women I know and asked if they would like to come along. All the way to the mall they went on and on about their lack of mathematical ability and the many horror stories associated with their mathematical experiences. However, as we began shopping, comparing items, and computing the discounts, I began to notice that the women were very competent at calculating the cost of each item after the discount. After

deciding what items we would buy, we made our move to the checkout counter, and on the way both women mentally calculated to the penny how much they would have to pay for their items, including tax. I never saw either of the two women use a calculator, a phone, or any other device to make their calculations, however, they had calculated the total cost to the penny. The question that I asked myself was if they were that terrible at math, how could they have calculated those prices so accurately. After being dumbfounded for several minutes, I decided to ask that same question to each of the two women. At almost the same time, they both proclaimed that it had nothing to do with math, it was shopping. People such as Mukhopadhyay, Powell, & Frankenstein claim that this is not uncommon because many people do math every day they just do not consider the activity mathematical (2009, p. 69). According to Barta and Brenner (2009), "research supports ...[the] contention that mathematics can be found in many different activities and may not even be perceived by the actors as an example of mathematics per se" (p. 89).

Percentage of women teaching math and science as compared to men.

K-12

Our historically, socially, and culturally constructed gender roles have had an enormous impact on the percentage of women teaching elementary, middle, high school, and college math and science. The way that our culture has come to view mathematics and gender and because of the low level of math required could explain why according to the U.S. Census (2000), 79% of elementary teachers are women and 21% are men. From my experiences as an educator teaching early childhood education, I can say that most of my students are women. Although some are great students, most lack the mathematical ability to add, subtract, multiply, and divide real numbers and are majoring in early childhood education not because they want to be great teachers but because they believe the low level of mathematics required will be easy. However

for many, their perception of easy is suddenly altered when they are unable to add basic fractions. Many of these students do not have the ability to perform basic mathematical functions, what many would describe as arithmetic, and have no interest or desire to learn. The problem is: how will they be able to teach the basics, when they don't know how to do the basics themselves? Early childhood mathematics is where most of these kids get their foundation; however, if we don't have teachers who understand these basic concepts how can we expect them to be successful teachers.

According to the U.S. Census (2000), 54.9% of all secondary mathematics teachers are women and 45.1% are men. These women have found a space to resist the hegemonic reproduction of gender roles concerning the learning of advanced mathematics. Where we really see a gender difference is in postsecondary mathematics. For example, in Donna Saye's thesis *The road seldom taken: status of women in mathematics departments in colleges and universities in Georgia* (2002) she discusses the under representation of women in math departments. The U.S. Census (2000) data showed that 75.3% of men taught postsecondary mathematics while only 24.7% are women. However, all this is understandable considering that according to Morris, "it is only in recent history that women have been able to attain Ph.D.'s and land positions within universities (2006, p. 205).

In Lorelei Brush's, *Encouraging Girls in Mathematics* (1980), she examines the reasons why girls don't seek to study mathematics and is concerned about how their lack of mathematical knowledge functions as an oppressive gateway. Brush states, "we need to know why students decide to quit mathematics, in order to reverse the process and encourage them to keep studying the subject" (p.1). Brush's research has shown that girls and women are less likely to seek out mathematical knowledge and this could result in lower numbers of women with the

mathematical knowledge necessary to participate in jobs that require a high aptitude in mathematics and a basic level of numeracy. According to Appelbaum, other researchers have suggested that “lower mean scores on tests of mathematical ability, more negative attitudes, the comparatively rarer perception of mathematics as a useful body of knowledge and skills, and *discouraging influences of the social milieu*” (1995, p. 133) have had a tremendous impact on the number of girls seeking to learn mathematics.

So why have we come to this in our society? Women have made many contributions to mathematics and science; however because of all the myths and stereotypes about women when it comes to these subjects, many are still made to feel inferior. This is something that we need to change in hopes of encouraging more females to study mathematics and science. However, when it comes to mathematics, our social and cultural conditioning in terms of gender has been very influential in creating an environment where "girls were felt to lack something, even when they were successful, ...[and] boys were felt to possess the very thing that girls were taken to lack. ...Girls are still considered lacking when they perform well and boys are still taking to possess something even when they perform poorly" (Walkerdine, 1998, p. 17). From my personal experience, there are just as many high achieving females as there are high achieving males. I fail to see a gap in achievement in terms of gender. According to Walkerdine (1998), "femininity and academic achievement are not, ... incompatible, but their relationship, ...is neither problem-free nor without specific effects" (p.108). Walkerdine (1998) questions the statistics on the studies in her text that showed a statistical significance in the differences between girls' and boys' achievement by saying that there was never any significant difference in girl and boy achievement and concludes that even with all of their socially and culturally constructed baggage, girls are still doing just as well as boys.

Conclusion

Throughout this chapter, we have seen many examples of the roles that race, gender, and social class play in the construction of our attitudes and perceptions of education and mathematics, and it is easy to see, from a postmodern perspective, that these attitudes and perceptions have all been historically, socially, and culturally constructed. When considering whether these attitudes and perceptions were constructed for some purpose or just a natural evolution of culture and society, the evidence suggests for some purpose. For example, we have seen the influence of education and how it has historically been used as a form of control, cultural intolerance, and “political and economic exploitation” (Anderson, 1988, p. 3). The education of Native Americans, African Americans, and those other groups of people considered inferior has always been about control. For instance, if education can be used to make a “man feel that he is inferior, you do not have to compel him to accept an inferior status, for he will seek it himself” (Woodson, 1933/1990, p. 85). We have seen this control reinforced by the many myths and stereotypes perpetuated by junk science or pseudoscience articulated with Darwinism to convince the masses that controlling other people and making them feel inferior is the morally right thing to do.

We have seen how standardized tests are used as gatekeepers and as an extension of Social Darwinism classifying students in terms of race, gender, and social class and using these classifications as a means of reinforcing their inferior or superior status for the primary reason of reproducing the status quo. Therefore, it is in the best interest of many who wish to maintain the status quo in terms of gender, race, and social class that math remain a gatekeeper. Scores on standardized tests can certainly be used to discriminate and oppress and that is why for most educators, especially mathematics educators, one of the primary talking points when it comes to

race, gender, and social class is the achievement gap. However, throughout this chapter we have explored a number of reasonable causes for such an achievement gap in terms of race, gender, and social class, such as sedimented inequality, poverty, and our hegemonically constructed social, cultural, and sub-cultural views of education. For instance, given the historical treatment of many African-Americans, Native Americans, and women, it would be unbelievable if there wasn't an achievement gap. Ladson-Billings (2006) posit that when we consider the type of education that many of the black students received "why, then, would we not expect there to be an achievement gap?" (p. 5). Many people have worked very hard to ensure that the achievement gap stays in place. For instance, in *Testing for Order and Control in the Corporate State* (1972), Karier discusses the racist history of standardized testing and exposes its connection to capitalism and labor stratification. Although the purpose of education is to give people opportunities for upward mobility, it has historically been used as a gatekeeper that restricts opportunities for the majority of the masses.

Countless studies, however, have shown that different races and ethnic groups as well as males and females are equal in terms of intrinsic educational or mathematical ability. Therefore, it is absurd for any individual to think for even an instant that a person's race, gender, or social class makes them mathematically incompetent. From my experience as an educator, I see no big difference in academic achievement when contrasting students in terms of race or gender. In addition, Martin & McGee, state that they "do not know any normal African-American children who are incapable of learning mathematics and achieving at the highest levels and we have yet to discover evidence to the contrary" (2009, p. 209). Although there is no evidence that minorities can't do mathematics, most of the populace have been constructed to believe it is true. These views have become so embedded in our culture that today many people view them as the norm.

These historical stereotypes have had a profound effect on education because many students still fall prey to negative racial or gender stereotypes that convince them they cannot do well in mathematics. The many stereotypes of junk science that have worked to keep minorities and women oppressed are still firmly embedded in our culture.

Therefore, since there are no differences in terms of race or gender when it comes to mathematics aptitude, the achievement gaps must be a result of environmental differences developed through social and cultural interaction. However, as we have seen throughout this chapter there are people who wish to control and oppress and it is in their best interests to keep the masses uneducated because education is the great equalizer and a threat to their power. We have seen this carried out by means of “a perverse system of discrimination against black people – a system that reproduce some of the most despicable forms of inhumanity and inequality” (McCarthy, 2007, p.131). For example, in Freire & Macedo’s 1987 text *Literacy: reading the word and the world* they argue that the people in power use their power to control education in order to maintain the status quo. Gutstein (2009) expands their discourse when he posits “capital has no use for such an educated mass of youth of color who might use their knowledge to rearrange the structural inequalities that oppress them” (p.153). Scholars such as Gutstein (2006, 2009), Watkins (2001), and Woodson (1933/1990) are seriously concerned about how schools in the United States have been used as a means of social and economic control of African-Americans and many other minorities. All of these scholars argue that education for African Americans was, and still is, to ensure their subordinate status. For instance, although most African American youth go to school, Gutstein (2009), argues “the high-quality, college preparatory education that *all* low-income students of color need to participate fully in a democratic society, and for which their communities have fought for over a century, has been

systematically denied to them” (p.153). All of these influences have functioned to create an environment that legitimizes and reproduces gender, racial, and class relations. But this seems to contradict the purpose of mathematics which is to liberate.

Today, it is no longer morally, socially, culturally, or politically correct to condone racism or sexism; however, there are some who still hold to the views of the past and that is why today racism and sexism are carried out in sly and subversive ways. Throughout our history people have done whatever they could to control the flow of knowledge and this includes the education of Native Americans, African Americans, and those considered inferior in some way. Why is today any different? The problem is knowing how to control entire groups of people and do it in way that is obscure or hidden. Therefore, education has been, and is still, a tool to ensure that racism and sexism remains but is hidden from the masses. A type of educational hegemony that convinces the masses through the use of education and the media that math is hard, that boys are better than girls at doing it, and that minorities just don't have the abilities needed to learn. All of these influences have had a profound impact on our social and cultural attitudes and perceptions of education and mathematics and give us a better picture of why we have teacher shortages in math and science and why African Americans, Hispanics, and Native Americans are under-represented. For example, “current statistics indicated those who study advanced mathematics are most often white males. Women and most minority study less mathematics and are seriously underrepresented in careers using science and technology” (Appelbaum, 1995, p.182).

Throughout our history in the United States, we have seen the end of slavery, the women's and civil rights movements, and many others, and all of these movements have worked at changing the status quo and opening doors for the many who'd been oppressed for so long.

Nevertheless, due in part to the legacy of slavery, racism, sexism, and discrimination, Native Americans, African Americans, Hispanics, and women still face numerous disadvantages in terms of education. Many believe that these advancements have brought an end to racism, sexism, and economic exploitation; but the truth is that although some people have become liberated, there are still large masses of people who remain oppressed. There is still prejudice and discrimination, and although the doors have been opened for some, it is still closed for many. It is unfortunate that in the 21st-century we are still dealing with issues of race, gender, and social class but the truth is they all still matter. However, Appelbaum, argues

creating a just society in which women and various ethnic groups enjoy equal opportunities and equitable treatment is no longer an issue. Mathematics has become a critical filter for employment and full participation in our society. We cannot afford to have a minority of our population mathematically illiterate: equity has become an economic necessity. (1995, p.182)

Mathematics is very important to the success of our culture and society and we can't afford to have a minority of our population mathematically illiterate and innumerate. Therefore, why does a majority of the population lack this knowledge? Although there have been great gains in the plight of Native Americans, African Americans, the poor, women, and others, they still remain at a disadvantage when it comes to wealth and education. For example, the achievement gaps aren't just in terms of academic achievement but also in terms of politics and economics. For instance, only 21% of politicians are women and most women make only 78% of what men make doing the same job, even though the women may do the job better. All of these groups still face the socially and culturally constructed world of institutional racism and discrimination in all facets of everyday life ranging from education, housing, employment, and the criminal justice system.

CHAPTER 4

INTELLECTUALS, ANTI-INTELLECTUALS, AND MATHEMATICS

As I look back through our history, intellectuals of all types have made a huge impact on the world as it is today. They are a necessary component for the future of our country, democracy, and the world because the problems of today require that we sometimes need to rigorously and critically analyze information in order to find the best solutions. Intellectuals in mathematics and science have helped the United States become a very powerful nation. Without their ideas on various topics and their scientific, mathematical, and technical knowledge, our democracy would become a thing of the past because we would not have the power to deter the many tyrants and dictators that seek to oppress. Without all types of intellectuals, questioning and speaking out on our uses of power, we may become the tyrants. Even though our country is not exempt from creating forms of oppression, as well as some cruel and nasty uses of power, most of us still stand for justice and equality, and the success of our country is directly related to intellectuals and how we educate our children.

But what have intellectuals had to do with these issues? Intellectuals have played a very influential role in shaping our current social and cultural attitudes and perceptions. For example, intellectuals, according to Stuart Hall in his paper titled *Gramsci's relevance for the study of race and ethnicity* (1996), are “the principal agents ...who have a specialized responsibility for the circulation and development of culture and ideology” (p. 432). Therefore not only can they shape our culture and ideology, they have a responsibility to do so. According to Edward Said in *Representations of the intellectual* (1994), “the intellectual is an individual endowed with a faculty for representing, embodying, articulating a message, a view, an attitude, philosophy or opinion to, as well as for, a public” (p.11). Therefore, intellectuals have an enormous amount of

influence in shaping the dialogue and also shaping the way the public comes to perceive an issue. So what do intellectuals have to do with mathematics and the negative views of mathematics that run rampant in our culture and society? One reason could be the negative elitist view of intellectuals and their association with academia, education, and mathematics. Another reason could be that learning mathematics is mostly a function of intellectual labor because it requires a person to think. In addition, “mathematical development,” according to Paul Ernest in *New Philosophy of Mathematics* (2009), is also “a function of intellectual labor, ...[however he goes on to say] its creators and appliers are moral beings engaged in voluntary actions” (p. 58).

Although not all mathematicians and scientists are considered intellectuals, learning mathematics and mathematical development are associated with intellectuals and therefore mathematics by some transitive nature becomes connected or associated with intellectuals. Negative attitudes and perceptions about intellectuals have led to negative attitudes and perceptions concerning mathematics and no matter how far from the truth these views may be, because of these perceived associations, the motivation to learn and study mathematics is almost nonexistent. Therefore in this chapter, I seek to better understand the role that intellectuals, anti-intellectuals, and anti-intellectualism have played in our historically, socially, and culturally constructed attitudes and perceptions concerning learning, education, and mathematics. The study and development of mathematics are very important intellectual activities because the intellectual labor involved can build a scaffold, foundation, or bridge to new and exciting ideas by getting people to think and reflect on things or ideas that they never would have otherwise. Therefore, I seek to better understand how these views have created an environment where people considered intellectuals are persecuted and treated as second class citizens and where people have no motivation to learn anything, much less math? My suspicion is that these views

are a byproduct of the ongoing battle between intellectuals and anti-intellectualism for the control of the masses. Since the learning of mathematics and mathematical development are functions of intellectual labor, it is important to understand how our views about learning, education, and mathematics have been strongly influenced by intellectuals, anti-intellectuals, and anti-intellectualism, and how these views have been historically, socially, and culturally constructed. Therefore, in an attempt to answer some of these questions, I will begin this journey by looking at the concept or notion of an intellectual and end with a discussion on anti-intellectualism all the while looking for the connections between the two modes of thought and the learning and teaching of mathematics.

What is an intellectual?

My view of an intellectual.

Before doing the research for this chapter, I associated an intellectual with a well-rounded person. I considered intellectuals as people who were experts or professionals in one field but also very skilled and knowledgeable in others. For instance, I considered intellectuals to be people who are not only knowledgeable in the academic sense, but who also have a grasp on the many different practical aspects of life. I guess my intellectual was someone similar to Emerson's intellectual as he describes in the *American Scholar* (1837). For Emerson, the intellectual or 'one man' was the farmer, the professor, the engineer, the priest, the scholar, the statesman, the soldier, the artist. However, Emerson suggests that "man is not a farmer, or a professor, or an engineer, but he is all." Emerson's intellectual is a person who possesses expertise in not only one area of interest, but in many. I viewed an intellectual as a caring and compassionate person who values education and knowledge, fights for the less fortunate, and speaks out against all injustice.

Although I never considered a person an intellectual based on their occupation, I consider most scientists and mathematicians, intellectuals. I consider most teachers intellectuals because many are caring and compassionate and value knowledge and education and seek to fight for justice and equality. However, my definition of a teacher does not represent a teacher necessarily in the formal sense. My teacher can exist outside the boundaries of a school. For example, a farmer, secretary, factory worker, artist, musician, or any person who is willing to share their knowledge with others could be considered a teacher. Teachers are very important in creating a better society because without teachers, we would constantly be reinventing the wheel. Without teachers, we would have no way of passing all our cultural capital to the next generation. I view intellectuals as people who were interested in the advancement of the human race, not its decline. Although I have always viewed intellectuals as positive figures, a positive force in society, I have noticed, for a long time now, that there are many groups that express discontent and hatred towards intellectuals and believe them dangerous, a threat to society. The question is: why? What have intellectuals ever done to deserve such treatment? Shouldn't we value such people? Therefore, since I see intellectuals in a positive light, I have to contemplate why there are those who view intellectuals in such a negative way. How can their views concerning intellectuals be so different from mine? For instance, how have I come to view intellectuals and is my current view of intellectuals anywhere close to how the populace views intellectuals?

What are some common definitions of an intellectual?

When I started looking for definitions of an intellectual, I found a somewhat endless supply. As I look at these definitions, I see many similarities and some differences in the way each source defines an intellectual. For example, some of these definitions consider a person's occupation or profession, most of which are associated with academia, and some define

intellectuals as rational people who rely on intellect rather than emotion. So what is intellect? Why would rational people rely on intellect rather than emotion? According to Hofstadter in *Anti-intellectualism in American life* (1962), intellect “is the critical, creative, and contemplative side of the mind” (p. 25). But what does it mean to reason and what is the contrast between intellect and feelings, emotions, and instinct? To reason means to use rational thought in order to better comprehend and acquire knowledge in a way deemed as reasonable and sane. The question is by whose definition of reasonable and sane. In reflecting on these ideas, I can see the enormous impact that the Enlightenment period has had on our culture. But is intellect all that it takes to make an intellectual? According to Thomas Sowell in his text *Intellectuals and Society* (2009), the answer is no. Sowell defines intellect as “the capacity to grasp and manipulate complex ideas” (2009, p.2). He argues that just because people have intellect does not mean they are intelligent. What he is trying to say here is that superior intellect does not correlate with wisdom. For example, just because a person is of superior intellect does not mean that he/she are wise. However, we must understand that having wisdom does not mean that a person is intelligent.

What are the many types of intellectuals and what is their role in society?

Non-functional or Functional intellectuals

Intellectuals play many roles in our society including both social and political. No matter how strict these definitions or classifications define the notion of the intellectual, I still feel that all people are intellectuals to some degree. Italian Marxist, political activist, journalist, major theorist, and intellectual in his own right, Antonio Gramsci (1891 - 1937) also believed that all men were intellectuals. For example, Gramsci posits in his *Prison Notebooks* (1971),

all men are intellectuals, one can therefore say: but not all men have in society the function of intellectuals. Thus, because it can happen that everyone at some time fries a couple of eggs or sews up a tear in a jacket, we do not necessarily say that everyone is a cook or a tailor... Each man, finally, outside professional activities, carries on some form of intellectual activity, that is, he is a 'philosopher', an artist, a man of taste, he participates in a particular conception of the world, is a conscious line of moral conduct, and therefore contributes to sustain a conception of the world or to modify it, that is, to bring into being new modes of thought. (p. 9)

Since all men are considered intellectuals, but do not function in society as intellectuals, people are typically classified as non-functional or functional intellectuals.

According to sociologist Syed Alatas' *Intellectuals in Developing Societies* (1977), "a non-functional intellectual, though educated, is passive mentally ...[and] accepts what is taught to him uncritically. He is not emotionally committed to intellectual pursuits and does not spend time reading on serious subjects" (p.15). In this sense, a nonfunctional intellectual could be a person, maybe a teacher, who although may have graduated from college and earned a degree no longer feels the need to learn anything new. For instance, I once heard a young college student who was going to college in order to become a teacher say on graduation day "Thank goodness, I've graduated. I'll never have to read or learn anything else ever again." For a nonfunctional intellectual the thought of intellectual labor is very discouraging and too many consider it hard work. They tend to go with the flow and never question the status quo, never rock the boat, even in the face of injustice. If a nonfunctional intellectual does read, they tend to read about mundane events of everyday life, and never on practical subjects needed to function critically in society. Another type of nonfunctional intellectual are the pseudo-intellectuals who according to Sowell,

are “the less intelligent or less knowledgeable members” (2009, p. 4) of the academic profession. These nonfunctional intellectuals are typically passive and never put their ideas to the test.

Traditional Intellectual

A functional intellectual is “a person who is very active mentally and could pose, define, analyze, suggest solutions, and solve problems” (Alatas, 1977 p. 16). A functional intellectual is a person who is constantly thinking, constantly posing questions in an attempt to find solutions and solve problems in a wide variety of contexts. Antonio Gramsci theorized that there were two types of functional intellectuals in society: traditional and organic and considered “the man of letters, the philosopher, the artist” (1971, p. 9) as traditional intellectuals. Historically a man of letters was a person who could read and write. Informally it basically meant that the person was literate. For example, in public if a person asked, are you a man of letters? A reply of yes meant that you were able to read and write. However, formally a man of letters was considered a person who made their living writing. According to Said, traditional intellectuals are people “such as teachers, priests, and administrators, who continue to do the same thing from generation to generation” (1994, p. 4). Although traditional intellectuals consider themselves as an independent autonomous group with no class or political affiliation, we must all remember that they are linked historically, socially, and culturally, with many of the institutions responsible for the reproduction of the masses. Therefore, they are conditioned by these institutions and are used to reproduce the status quo from generation to generation for the benefit of the dominant society. Stuart Hall states that traditional intellectuals “align themselves with the existing dispositions of social and intellectual forces” (1996, p. 432).

Because of our historically constructed views of an intellectual such as a man of letters, philosopher, or writer, people such as Sowell, Foucault, and Hofstadter view the term

“intellectual” to represent not just a person, but an occupational category. We have seen occupation play a major part of the definition of an intellectual. For example, Sowell posits that “intellectuals are people whose occupations deal primarily with ideas – writers, academics, and the like” (2009, p. 2). When asked what it is that intellectuals do, Marla Morris in *Jewish Intellectuals and the University* (2006), states “intellectuals write” (p. 195). Hofstadter describes an intellectual as being “a writer or a critic, a professor or a scientist, an editor, journalist, lawyer, clergyman, or the like” (1962, p. 26). However, Hofstadter and Foucault thought there was more to being an intellectual than just a person's occupation. To Hofstadter, a true intellectual is someone who "lives for ideas– which means that he has a sense of dedication to the life of the mind which is very much like a religious commitment” (1962, p. 27). For example, just because people perform intellectual activities at work or as part their professional activities, does not necessarily mean that they are considered intellectuals under Hofstadter’s definition.

In *Power/Knowledge* (1980), Foucault considered writers of old universal intellectuals because they were “a universal consciousness, a free subject, ... [a person] counter-posed to those intellectuals who were merely *competent instances* in the service of the State or Capital-technicians, magistrates, teachers” (p. 127). The universal intellectual, according to Foucault is a “man of justice, the man of law, who counterposes to power, despotism and the abuses and arrogance of wealth the universality of justice and the equity of an ideal law” (1980, p.128). Many of the founding fathers could be considered universal intellectuals because they were writers, men of laws, who fought against the power and tyranny of the British all with the hopes of one day constructing a more just society. According to Susan Jacoby in *The Age of American Unreason* (2008), “one of the most remarkable characteristics of America's revolutionary generation, was the presence and influence of so many genuine intellectuals" (p. xiii). Therefore

the concept of the universal intellectual as a writer, a person not associated with state or capital, free to speak out against injustice of any nature and give voice to the meek and powerless, could be where some of my views concerning intellectuals may have taken root. Foucault theorized that intellectuals were also classified by their "class position (whether as petty-bourgeois in the service of capitalism or 'organic' intellectual of the proletariat) ...[as well as their relation to the] politics of truth" (1980, p. 132).

When reflecting back on our history we can see the enormous influence that these intellectuals have had on our culture and society. Many of their writings have produced remarkable things and have changed the world in profound ways. However, today we have a serious problem because according to Jacoby (2008), "the current American relationship to reading and writing, by contrast, is best described not as illiterate but as a-literate" (p. xviii). She goes on to describe the horrifying statistics showing a huge decline in the number of people who read not because they are illiterate but because they have no interest or desire to do so. Furthermore, according to Said, "the intellectual who claims to write only for him or herself, or for the sake of pure learning, or abstract science is not to be, and *must not* be believed" (p. 110). Every writer writes in the hope that someone will read their words. A writer needs a reader. Jardine et al. warns us that if no one reads and writing disappears, so will the writers (p. 258).

Jacoby (2008), warns us that "in this increasingly a-literate America, not only the enjoyment of reading but critical thinking itself is at risk"(p. xviii). She goes on to say that "the decline of recreational reading during the past two decades can only be attributed to competition from other forms of entertainment. ...but only reading is indispensable to intellectual life" (2008, p. 251). If someday these many other forms of entertainment were to disappear, books would become like gold. But in a world where no one reads, who will ever know these ideas? If

everyone stops reading, then many intellectuals will have no way to communicate or convey their message thereby leading to the death of the intellectual or at the very least, the death of the ‘universal’ intellectual as described by Foucault. Jacoby warns that "if the slice of our cultural diet devoted to reading continues to shrink, intellectual life will inevitably become further impoverished" (2008, p. 257). But why would we stop reading? Is our decline in reading really the result of competition from these other forms of entertainment or could there be a more influential lurking variable controlling this response. For example, according to Derrida (1976, 1978, 1981), writing is a threat. Therefore, it is in the best interests of those who feel threatened by such writings to encourage the masses not to read.

Specific Intellectuals

Because of the decline in reading, the universal intellectual, the once masters of truth and justice for all have become obsolete and will inevitably cease to exist. According to Foucault, this death is probably not entirely due to the fact that people are reading less, but that intellectuals no longer work in the realm “of the ‘universal’, the ‘exemplary’, the ‘just-and-true-for-all’, but within specific sectors, at the precise points where their conditions of life or work situate them (housing, the hospital, the asylum, the laboratory, the university, family and sexual relations)” (1980, p. 126). The notion of the specific intellectual “has emerged since the Second World War ...[and suggests that] perhaps it was the atomic scientist (in a word, or rather a name: Oppenheimer) who acted as the point of transition between the universal and the specific intellectual” (Foucault, 1980, p. 127). Just as it sounds, the specific intellectual works with others on specific struggles. For example, they could be considered people who work to gain consent of potential supporters on issues of racism, sexism, and other specific injustices.

Foucault considered the “savant or expert” (1980, p. 128) specific intellectuals. However,

according to Sowell, an expert is “a special occupation which overlaps that of intellectuals ...[and is] not wholly coincident with it” (2009, p. 22). For example, Sowell only considers some experts intellectuals, and determines this by the end product that the expert may produce. A person may be an expert in American history or theoretical mathematics and be considered an intellectual because their end products are ideas. However, experts in fields such as medicine, engineering, automotive repair, or manufacturing differ from the previous types of experts because they produce a product or service. Therefore they are not considered intellectuals. Sowell considers people such as Karl Marx and Adam Smith intellectuals because they disseminated and produced ideas, however, their ideas never influenced the building of a bridge, skyscraper, or anything of consequence. What I view as odd, is that, if they had built a bridge or skyscraper, they would have never been considered as intellectuals. Why? Wasn't the design of the bridge or skyscraper an intellectual activity? For example, doesn't the idea of the bridge or skyscraper come before the design? Someone had to think them up first. What about all the thought that goes into actually designing just one of them? Is this not an intellectual activity? So why have we come to view some occupational categories as intellectual and others as not? Although to be considered an expert of either type, a person must first pass the criteria established by the dominant social and cultural establishment. For example “to be an expert you have to be certified by the proper authorities ...[and] this is especially true when sensitive and/or profitable areas of knowledge are at stake” (Said, 1994, p. 77). However, the need to pass some criteria or be certified by the proper authorities is not required once the media is involved.

For example, according to Charles Pierce in *Idiot America* (2009), “once you're on television, you become an expert, with or without expertise” (p. 34). Since many times these experts attempt to speak about topics outside their area of expertise it is possible for their advice

to be wrong and that is why the label of an expert is jaded and viewed very negatively by some in our culture and society. Furthermore, when looking from a postmodern perspective, things are constantly in flux, forever changing, so this leads me to question the notion of an expert. Can there truly be such a person. For example, although a person was an expert 50 years ago, does not mean that they are experts today. Their level of expertise was only for a brief measure of time and I have to question if they actually reached a level of expertise at all. For example, the famous classical guitarist Andrés Segovia, was considered by many to be a virtuoso. However, when asked in an interview about how it felt to be a virtuoso, he replied that he didn't know because he considered a virtuoso a master that had reached the end of learning. For instance, being a virtuoso meant that there was no more to learn. He went on to say that he was still in the process of learning how to play guitar, hence there was no way he could be a virtuoso.

Therefore, just because a person is an expert does not mean that they are intellectuals because many scholars only consider those experts whose end products are ideas as intellectuals. It is somewhat suspicious that people who work in fields such as mathematics and science are not considered intellectuals. However this is somewhat understandable when we consider that "math is generally taught as an applied discipline, not as an intellectual pursuit" (Appelbaum, 1995, p.121). Nevertheless, "mathematical work often involves talking and writing about imagined things" (Moschkovich & Nelson-Barber, 2009, p. 127). Mathematicians and scientists write, produce ideas, and perform a service and when I first considered the notion of an intellectual, people such as Isaac Newton, Nikolai Tesla, Albert Einstein, and Carl Sagan came to mind. Furthermore, most people fail to understand that mathematics is an important part of many intellectual pursuits. Math is everywhere. Mathematics is considered a foundation and a very important part of just about any science and some of the most profound intellectuals of our time

came from these fields. However, this label is reserved for people who typically are from the fields of the arts or the social sciences.

But why do we have to construct such classifications? Is it part of our competitive nature? Shouldn't all of these people be considered intellectuals? For example, doesn't the mechanic, engineer, or doctor think and formulate new ideas? This is a profound contradiction in the definition of the intellectual because we all think to some degree, we all produce ideas. All of our "work begins and ends with ideas, however influential those ideas may be on concrete things" (Sowell, 2009, p. 3). What comes to mind when I consider the contrast created here between the two types of experts, is C. P. Snow's two camps in *The Two Cultures* (1998) or the Freirean notion that the "intellectual activity of those without power is always characterized as non-intellectual" (Freire & Macedo, 1987, p.122). Even though, according to Gutstein (2006), "a Freirean pedagogy proclaims that those without power create viable, valuable knowledge" (p. 200).

Organic Intellectuals

Gramsci was interested in the formation of specific intellectuals who will be organic to the interests of the working class. He felt morally obligated to assist in the creation of these organic intellectuals by writing a column in a journal called *L'Ordine Nuovo* in hopes of winning over as many traditional intellectuals to the revolutionary cause as possible. Although school is considered part of the system of ideological hegemony in which people are reproduced in order to maintain the status quo, Gramsci had hopes that education, and teachers, would help in the construction of a counter hegemonic revolutionary class. According to Gramsci, organic intellectuals are

the thinking and organizing element of a particular fundamental social class ... [and] are

distinguished less by their profession, which may be any job characteristic of their class, than by their function in directing the ideas and aspirations of the class to which they organically belong. (1971, p. 3)

According to Said,

Gramsci believed that organic intellectuals are actively involved in society, that is, they constantly struggle to change minds and expand markets; unlike teachers and priests, who seem more or less to remain in place, doing the same kind of work year in year out, organic intellectuals are always on the move, on the make ... Today's advertising or public relations expert, who devises techniques for winning a detergent or airline company a larger share of the market, would be considered an organic intellectual according to Gramsci, someone who in a democratic society tries to gain the consent of potential customers, win approval, marshal consumer or voter opinion. (1994, p. 4)

Many use their positions as intellectuals to help solve the problems and issues that exist in their communities. According to Cameron McCarthy in *Representing the Third World intellectual* (2007), organic or subaltern intellectuals are people "who emerge directly from the masses and who seem inextricably bound to their fate" (p.133). Although they understand their place in society and their function in perpetuating the dominant ideology,

they rise and fall as they express a sense of community, and as they operate within the broader projection of the transformation of the fetters of society that constrain the group's will to power and desire for the good life. (2007, p.133)

Urban/Rural/Countryside Intellectual's

Other types of intellectuals include the urban intellectual, the rural intellectual, and the countryside intellectual. The urban intellectuals are a subset of the organic intellectuals because

according to Gramsci, they “have grown up ...[organically] along with industry and are linked to its fortunes” (1971, p.14). In contrast, Gramsci considers that “intellectuals of the rural type are for the most part “traditional ... This type of intellectual brings into contact the peasant masses with the local and state administration (lawyers, notaries, etc.)” (1971, p.14). Therefore, the rural intellectuals play a very important role in the communication between the masses and the people in power and although they are considered traditional intellectuals who claim autonomy, they serve both a social and political function. The rural intellectual can sometimes be considered as a countryside intellectual. The countryside intellectual is a person whose labor consists of a great deal of intellectual or mental labor which is in contrast with the manual or physical labor done by most of the people in their respective communities. The countryside intellectual could be a priest, doctor, teacher, or lawyer who earns more money and has a higher standard of living than the average person in the community and therefore, in Marxists terms are viewed as members of the bourgeoisie.

However these intellectuals are far from being members of the bourgeoisie. For example, just because a person is a countryside intellectual does not mean that their income is that much higher than others in the community. Make no mistake, they are also exploited by the power of capital. However, because of their higher standard of living on average, they have come to represent “a social model for the peasant to look to in his aspiration to escape from or improve his condition” (Gramsci, 1971, p.14). Today we use the term meritocracy to describe this situation. Gramsci goes on to talk about how the average person always hopes that their kids will become intellectuals thereby becoming viewed by the public at large as respectable as well as raising the social status of the family. However, the average person’s attitudes towards the intellectual are contradictory at best. For example, the average person respects the “social

position of intellectuals ...but sometimes affects content for it, which means that his admiration is mangled with instinctive elements of envy and impassioned anger” (Gramsci, 1971, p.14).

Although there are some who admire and respect intellectuals, there are many who despise them. But why? The envy and impassioned anger that has been passed down from generation to generation has functioned to create an environment where our socially and culturally constructed attitudes and perceptions of intellectuals are very negative.

Private and Public Intellectuals

Other types of intellectuals that many would consider functional are the private and public intellectuals. William Pinar, in *What is curriculum theory?* (2004), considers Jean Paul Sartre a “private and public intellectual” (p. 22). He goes on to say that in order to become a private or public intellectual a person “must be always studying across the disciplines, as well as reading in-depth in at least one” (Pinar, 2004, p. 252). Bertrand Russell, for example, was both a public intellectual and a leading authority within a rigorous field” (Sowell, 2009, p.11). Another example of a public intellectual who has been very influential on our society is Edward Teller. Although Teller is considered by many to be the father of the hydrogen bomb, he convinced most of the public of the horror and destruction that could take place if people decided to use nuclear weapons. Many believe that private intellectuals are important to our society and culture, and this I agree, however, public intellectuals are the people that have the most influence on our society and culture because they can disseminate their message to a wider audience. The private intellectual may speak to individuals in their respective fields, while the public intellectual, especially today with the use of modern media, may speak to millions. However, according to Sowell (2009),

the impact of the intellectual, or of intellectuals in general, does not depend on there being so-called 'public intellectuals' who directly address the population at large, as distinct from those intellectuals whose ideas are largely confined to others in the respective specialties or to other intellectuals in general. Books with some of the biggest impacts on the twentieth century were written by Karl Marx and Sigmund Freud in the nineteenth century – are seldom read, much less understood, by the general public (p. 4).

However, Said posits that “there is no such thing as a private intellectual, since the moment you set down words and then publish them you have entered the public world” (1994, p. 12). But what if no one reads those words? Your thoughts remain private once again except for maybe the editors or proofreaders, which still only amounts to a small number of people.

I guess the main difference in private and public intellectuals is their access to mass media. For example, in his book *Absent Minds: Intellectuals in Britain* (2006), Collini argues that a public intellectual is someone who first achieves a level of creative or scholarly achievement and then uses available media to engage and discuss public concerns. Alan Lightman in his work *The Role of the Public Intellectual* defines the public intellectual as a person who is “often trained in a particular discipline, such as linguistics, biology, history, economics, literary criticism, and who is on the faculty of a college or university.” Lightman agrees with Said that once a person decides “to write and speak to a larger audience than their professional colleagues, he or she becomes a 'public intellectual.'” Therefore, public intellectuals are seen as communicators. Emerson's intellectual preserves the great ideas of the past, communicates them, and creates new ideas. He is the "world's eye." And he communicates his ideas to the world, not just too fellow intellectuals. They communicate ideas and knowledge to the public through the use of mass media by often appearing in print, radio, the internet, or

television. However, not everyone is accepted by the public. For example, from the public's perspective, many of the world's private and public intellectuals are viewed as elitists because of their association with academia or social status. Therefore, in order to be credible, a public intellectual must be perceived by the public as being truthful and autonomous. However, is there anyone who is truly autonomous? For example, according to Said, "all of us without exception belong to some sort of national, religious or ethnic community: no one, no matter the volume of protestations, is above the organic ties that bind the individual to family, community, and of course nationality" (1994, p. 40).

According to Lightman, there are three different levels of public intellectuals and with each comes a certain level of responsibility. Level one intellectuals only speak and write exclusively about their disciplines. However, level two intellectuals not only speak and write about their discipline they also speak and write about how their discipline relates to the social, cultural, and political world around it. The only way that a person can reach level III is by invitation only and this level is the one with the greatest responsibility. A level III public intellectual is someone "larger-than-life," someone that the public trusts and respects. A Level III intellectual is asked to write and speak about a large range of public issues, not necessarily directly connected to their original field of expertise at all. However, Lightman posits

such a person must be careful, he must be aware of the limitations of his knowledge, he must acknowledge his personal prejudices because he is being asked to speak for a whole realm of thought, he must be aware of the huge possible consequences of what he says and writes and does. He has become, in a sense, public property because he represents something large to the public. He has become an idea himself, a human striving. He has enormous power to influence and change, and he must wield that power with respect.

Because they understand their limitations and the enormous responsibility associated with becoming a level III public intellectual, many intellectuals will refuse the invitation. However many have accepted the invitation and have become outstanding role models as public intellectuals. For example, when I think of a level III public intellectual some of the names that come to mind are Albert Einstein, Carl Sagan, Noam Chomsky, Edward Said, Henry Louis Gates, and Antonio Gramsci. According to Lightman, “a public intellectual, although often starting out in academia, is not confined to a specific discipline or to traditional boundaries.”

However, it is with level III public intellectuals that people such as Sowell, Lightman, Alatas, and Johnson have the biggest issue, because public intellectuals often speak on matters beyond their area of expertise. For instance, although many public intellectuals are considered experts in their respective fields they tend to move to fields or issues for which they lack the knowledge or wisdom to communicate effectively. A prime example is when people who are experts in business start thinking that they can generalize their expertise in other areas such as education. This is equivalent to having your auto mechanic perform open heart surgery or your doctor repairing your transmission. According to Sowell, “the fatal misstep of such intellectuals is assuming their superior ability within a particular realm can be generalized as superior wisdom or morality over all” (2009, p.12). In Paul Johnson’s *Intellectuals* (1990), he disputes the right of the intellectual to move out of his or her own subject and into the realm of public affairs, and according to Alatas, in many cases the public intellectual’s knowledge “of subjects outside his field is comparable to that of the layman” (1977, p.16).

What about Emerson’s American Scholar? Wasn’t his well-rounded person of action in possession of skills and expertise in many areas of life? Sowell (2009) warns us that public intellectuals have no business speaking outside there area of expertise and states

if knowledge is defined expansively, including much mundane knowledge whose presence or absence is consequential and often crucial, then individuals with PhD's are as grossly ignorant of most consequential things as other individuals are, since no one can be truly knowledgeable, at a level required for consequential decision – making our whole society, except within a narrow band out of the vast spectrum of human concerns. The ignorance, prejudices, and groupthink of an educated elite are still ignorance, prejudice, and groupthink – and for those with 1% of the knowledge in a society to be guiding or controlling those with the other 99 percent is as perilous as it is absurd. (p.17)

However, I would think that intellectuals would understand that no one knows everything and that they only possess a very small slice of knowledge. According to Sowell, intellectuals feel that they are smarter than most people and have a condescending view of those they see as below them, not on their intellectual level. This know it all attitude is why many in the public view intellectuals very negatively.

Public intellectuals play a very significant political role in society. Said recalls that “the great twentieth-century writer Jean Genet once said, the moment you publish essays in a society you have entered political life; so if you want not to be political do not write essays or speak out” (1994, p. 110). For example, according to Lightman, “it's not just enough to be interested in ideas, therefore; to count as a public intellectual ...one must participate in debate to clarify issues, expose the errors of other public intellectuals, draw attention to neglected issues and generally vivify public discussion.” The Palestinian literary critic Edward Said saw the *public intellectual* as

someone whose place it is publicly to raise embarrassing questions, to confront orthodoxy and dogma, to be someone who cannot easily be co-opted by governments or

corporations, and whose *raison d'être* is to represent all those people and issues that are routinely forgotten or swept under the rug. (1994, p. 11)

Hence, the role of the public intellectual should be to give voice to the people with no voice, to debate, analyze, and solve complex social issues. For example, “Sartre systematically refused to keep quiet about what he saw as inequalities and injustices in the world” (Scriven, 1999, p. xii). People such as Emerson, Said, Chomsky, and Sartre see the role of the intellectual as a moral one. They resemble the critical intellectuals in that they feel an obligation not to themselves but to the masses to speak out on the current issues of the day.

Intellectual Responsibilities

In *The Responsibility of Intellectuals* (1967), Noam Chomsky argues that the responsibility of intellectuals is to speak the truth and expose lies. For example, since most people have little to no knowledge of statistics and probability, it is very easy to use numbers and statistics as a method of spreading propaganda and misinformation with the intent of misleading the public. Said posits that the modern intellectuals role is

(that of disputing the prevailing norms) precisely because of the dominant norms are today so intimately connected to (because commanded at the top by) the nation, which is always triumphalist, always in a position of authority, always exacting loyalty and subservience rather than intellectual investigation and re-examination of the kind that both Woolf and Walter Benjamin speak about. (1994, p. 36)

It is the responsibility of the intellectual to inform these people of the facts and fight for what is right and to represent “the poor, the disadvantaged, the voiceless, the unrepresented, the powerless” (Said, 1994, p. 113). According to McCarthy

the intellectual is not simply an academic or an expert ensconced in the safety of the ivory tower; the intellectual is a transformative social subject committed to a particular articulation of the differential classed, raced, and gendered interest, needs, desires, and aspirations of embattled social groups. (2007, p. 133)

According to Freire, "authentic thinking, thinking that is concerned about reality, does not take place in ivory tower isolation, but only in communication" (2004, p. 77).

Aronowitz and Giroux in *Education still under siege* (1993), expand on Gramsci's notion of a functional intellectual by discussing the "changing nature and social function of intellectuals in their capacities as educators" (p. 45). According to Davis in *Teaching Mathematics* (1996), "Aronowitz and Giroux use the phrase 'transformative intellectual' to describe their sense of the teacher's role" (1993, p. 153). For example, some teachers are transformative intellectuals and seek to make

the pedagogical more political and the political more pedagogical [and] take seriously the need to provide the conditions for students to be able to speak, write, and assert critically their own histories, voices, and learning experiences ...come to grips with those ideological and material aspects of the dominant society that attempt to separate the issues of power and knowledge. This means working to create the ideological and material conditions in both schools and the larger society that give students the opportunity to become agents of civic courage, and therefore citizens who have the knowledge and courage to take seriously the need to make despair unconvincing and hope practical. (Aronowitz and Giroux, 1993, p. 46)

Aronowitz and Giroux argue that "the starting point ...pedagogically for such intellectuals is not with the isolated student but with collective actors in their various cultural, class, racial,

historical, and gendered settings, along with the particularity of their diverse problems, hopes, and dreams” (1993, p. 46). It is my hope that all teachers become transformative intellectuals.

Similar to the transformative intellectual is the contextual intellectual. For example, a contextual intellectual works

across the road blocks and naturalized separations that capitalism and imperialism have fabricated to divide and conquer the masses, divide and conquer subaltern groups embattled in the project of change. The contextual intellectual is versed in the magic arts of interpretation, and his special prerogative is a deconstructive assault on the taken-for-granted and naturalized terrain of the West. (McCarthy, 2007, p. 134)

However, the contextual intellectual is aware of the many issues that surround intellectuals and therefore, “must be willing to engage in self-criticism. She/he must be open to suggestion, open to the voices of the masses, open to the historical variability and nuances of the struggle of the masses for better life” (McCarthy, 2007, p.135).

Some teachers fall under the category of critical intellectuals who according to Aronowitz & Giroux are

ideologically alternative to existing institutions and modes of thought ... [and although this may seem somewhat political,] they do not see themselves as connected either to a specific social formation or as performing a general social function that is expressively political in nature. Their protests constitute a critical function, which they see as part of their professional status or obligation as intellectuals. (1993, p. 47)

Critical intellectuals have a moral obligation to fight for what is right, what is just, instead of for some specific group or political ideology. According to Said, Adorno is the poster child for the

critical intellectual because he was “paradoxical, ironic, mercilessly critical ...the quintessential intellectual, hating all systems, whether on our side or theirs, with equal distaste” (1994, p. 55).

An accommodating intellectual is very similar to the traditional intellectual in that they both "stand firm within an ideological posture and set of material practices that support the dominant society and its ruling groups” (Aronowitz & Giroux, 1993, p. 48). As the traditional intellectuals, the accommodating intellectuals are not aware of their role in the reproduction of the dominant class and although they claim autonomy, accommodating intellectuals "function primarily to mediate uncritically ideas and social practices that serve to reproduce the status quo" (Aronowitz & Giroux, 1993, p. 48). They are naïve in their articulation with the dominant ideology and therefore function in the reproduction of the masses. They never realize that they are used and controlled for the purpose of reproducing the status quo. Hegemony has such a grip on their psyche that many live their entire lives without ever noticing what is actually happening in the world around them. However, there are some intellectuals who are aware of the reproduction that is carried out and work very hard at getting us to look the other way, keeping us from ever seeing the world as it is by constructing a false reality that functions to maintain status quo.

This type of teacher falls under the category of hegemonic intellectuals. These people “do more than surrender to forms of academic and political incorporation, or hide behind spurious claims of objectivism; they self-consciously define themselves through the forms of moral and intellectual leadership they provide for dominant groups and classes” (Aronowitz & Giroux, 1993, p. 48). These intellectuals

provides various factions of the dominant classes with a homogeneity and awareness of their economic, political, and ethical functions ...[and are typically] found on the

consulting lists of major foundations, on the faculties of major universities, as managers of the culture industry, and in spirit, at least, in teaching and administrative positions at various levels of schooling. (Aronowitz & Giroux, 1993, p. 49)

According to McCarthy, in contrast to the organic intellectual is the authoritarian or resentment-type intellectual who “defines his identity through the negation of the other. Such an intellectual exist in real or imaginary exile from society's working poor and is driven by a dangerously narrow-minded program of retributive morality” (2007, p. 134). McCarthy argues that the organic intellectual has been viewed as

a positive transformative force in world history, the authoritarian or resentment intellectual is seen as a negative presence. The distorted communicative practices of the resentment intellectual are not the consequence of an evil nature. Instead, they are rooted in the conditions of production of capitalism itself, its modes of organization, and its colonialization of the life world. (2007, p.138)

Typically the resentment intellectual is a very selfish individual who “seeks, remorselessly, to secure and defend the ideological environment of his own petty bourgeois interests” (McCarthy, 2007, p. 142). Paulo Freire in the *Pedagogy of the Oppressed* (1970), discusses intellectuals that are considered authoritarian or resentment type intellectuals and asks us to consider intellectuals whose purpose is to liberate and not oppress.

Are intellectuals useful to society?

Are intellectuals useful to society? Some would say no, because of how intellectuals have been portrayed historically, socially, and culturally. However, according to Neil Harding in *Intellectuals and socialism: making and breaking the proletariat* (1997), we need intellectuals and their ideas. For example, many of the advancements in technology, medicine, and science

that we enjoy today are a result of intellectuals. We also need intellectuals to frame and explain many of the issues of concern. Said posits, “intellectuals are individuals with a vocation for the art of representing, whether that is talking, writing, teaching, appearing on television” (1994, p.12). Although intellectuals are great communicators, actions speak louder than words. For example, “the new intellectual can no longer consist in eloquence, which is an exterior and momentary mover of feelings and passions, but in active participation in practical life, as constructor, organiser, 'permanent persuader' and not just a simple orator" (Gramsci, 1971, p. 10). This idea of active participation was a major part of Emerson’s intellectual. He considered inaction as cowardice. He states “without it [action], he is not yet man.” So what types of actions are associated with intellectuals? According to McCarthy

intellectual activism is not only embodied in the grand acts of mobilization of the public intellectuals such as W.E. Dubois or, more contemporaneously, bell hooks, Cornel West, or Michael Dyson, or Henry Louis Gates. Such intellectual activism is embodied in the popular acts of the masses in movement, in agency, of taking charge of one's own destiny, of seeking new grounds of survival and alternatives within the constricted choices offered in a capitalist racial order. (2007, p.130)

Intellectual activism could also be carried out as cultural action. For example, according to Freire,

cultural action is always a systematic and deliberate form of action which operates upon the social structure, either the object concerning the structure or of transforming it ...[and it] either serves domination (consciously or unconsciously) or it serves the liberation of men and women. (2004, p. 179)

Intellectuals are necessary to protect the interest and needs of people by standing up and speaking out against inequality and injustice. Sometimes action is required to question the actions of those in power or who have authority over others. However, this action may be dangerous to the intellectual or the group of people being represented by the intellectual or both. Because of this some intellectuals may never take action. This is why Said posits that “questioning subservience to authority in today’s world is one of the greatest threats to an active, and moral, intellectual life” (1994, p. 121).

According to Said, an intellectual's purpose in life is to advance human freedom and knowledge (1994, p. 17, p. 59). Intellectuals are typically open to different forms of analysis and they are usually the ones who give voice to people that typically have no voice. They are open to all possibilities and look for the truth from various angles and triangulations. They are compassionate and caring people who seek to alleviate all or at least some of the pain associated with everyday life who should “persistently [question] our intellectual practices and the consequences of our scholarship” (Harewood, 2007, p. 62). Therefore, I believe intellectuals are very important part of our society. After exploring the concept of the intellectual and their role in society, I can see where many of my views concerning intellectuals have originated and why the public views intellectuals so negatively. From here, I will move on to discuss the groups that have a strong dislike for anything considered intellectual, and especially intellectuals. These groups have constructed and perpetuated many of the stereotypes and myths used to shape our negative cultural and social views of intellectuals. Since many intellectuals are perceived by the public as connected to academia in some way, many of our socially and culturally constructed views of education and learning are a direct and indirect result of our views of intellectuals. For example, many of our socially and culturally constructed views of intellectuals are negative and

this results in negative views of education and learning. But where did these negative views come from?

Anti-intellectuals and Anti-intellectualism

After getting a better understanding of what intellectual means, I will next explore the rise of anti-intellectualism in society and popular culture and how it has functioned to discourage people from becoming proficient in anything perceived as academic, especially mathematics and science. The consequences of anti-intellectualism on our culture and society as we know it have resulted in a lack of motivation in acquiring mathematical and scientific knowledge. This lack of motivation will eventually seriously impact our democracy. Furthermore, intellectuals and education can help break down many of the barriers that seem to cause this country and the world in general so much distress. Intellectuals are a valuable part of our society and along with education help make our world a better place for all species. However, one thing that we need to be aware of is that anti-intellectuals seem to be winning the war for the minds of the masses. For example, anti-intellectualism is a powerful force and today student anti-intellectualism is off the charts. According to Steinberg (1996), student anti-intellectualism is "potentially more harmful to the future well-being of American society than any of the other problems now grabbing the headlines" (p. 28).

One of the first derogatory uses of the term intellectual came after the Dreyfus Affair in the late 19th century. During this affair, the term intellectual became associated with the people who defended Artillery Officer Captain Alfred Dreyfus against false accusations made by the establishment and won. Since these people were seen as troublemakers and a danger to the status quo, the dominant establishment worked at creating false myths and stereotypes of intellectuals which functioned to create a negative perception of an intellectual in the eyes of the public. After

the Dreyfus affair, the term intellectual became associated with the anti-establishment and because of this many people considered intellectuals are often shamed or alienated. The same thing happened during the McCarthy era where intellectuals were considered socialists, egg heads, and even bastards. The influence of the McCarthy era still functions to create a negative view of the intellectual as an enemy to capitalism. Johnson (1990) adds fuel to this fire by ridiculing and criticizing intellectuals such as Rousseau, Shelley, Marx, Henrik Ibsen, Tolstoy, Hemingway, Bertrand Russell, and Jean Paul Sartre as possessing certain negative characteristics or traits not seen as acceptable by the masses. He describes intellectuals as cruel, rude, devious, lying, selfish, snobbish, greedy, cheating, power hungry, sexually deviate, egocentric, cowardly, alcoholic, drug abusing, intolerant hypocrites. He creates a very negative perception of anyone considered an intellectual as the worst of the worst. However, intellectuals are human and all humans, whether they are considered intellectuals are not, possess some of the same negative characteristics. Nonetheless the image of the intellectual being the only human to possess such characteristics have become so firmly embedded in our society and culture that today all intellectuals are viewed as evil, crazy, or part of the lunatic fringe. In most cases if someone calls you an intellectual they are not attempting to be flattering, but demeaning.

Isn't it ironic that one of the major cases that anti-intellectuals make against intellectuals is that they are subversive, dangerous, and pose a serious threat to democracy? However, there are many people that believe this to be a fallacy. In contrast to the tidal wave of anti-intellectual rhetoric, intellectuals and education both help lead us towards a more equal, fair, and just society. Hence, a lack of intellectuals and a lack of education could have serious ramifications on our society and democracy. Many of the founding fathers believed that without an educated electorate democracy was destined to fail. John Dewey in *Democracy and Education* (1916) also

expressed these concerns when he states

a government resting upon popular suffrage cannot be successful unless those who elect and who obey their governors are educated. Since a democratic society repudiates the principle of external authority, it must find a substitute in voluntary disposition and interest; these can be created only by education. But there is a deeper explanation. A democracy is more than a form of government; it is primarily a mode of associated living, of conjoint communicated experience. The extension in space of the number of individuals who participate in an interest so that each has to refer his own action to that of others, and to consider the action of others to give point and direction to his own, is equivalent to the breaking down of those barriers of class, race, and national territory which kept men from perceiving the full import of their activity. (p. 101)

Therefore I have to question: in who's best interest is it to not educate the masses and to create such a negative image of intellectuals? Intellectuals are our only hope for the future of our country, democracy, and the world because the problems of today require that we sometimes need to rigorously and critically analyze information in order to find the best solutions. We need more intellectuals not less.

Anti-Intellectualism

In order to understand the rise of anti-intellectualism in American society and popular culture, I first need to understand how anti-intellectualism is defined. The *Free Dictionary.com* defines anti-intellectualism as “antagonism to learning, education, and the educated, expressed in literature in a conscious display of simplicity, earthiness, even colorful semi-literacy.” The *way of the mind.com* defines anti-intellectuals as “people who deride the mind, who pride themselves on not thinking, on not using their reason, ...[and believe] that thinking and learning are trouble,

that they lead people to unhappiness, sinfulness, asking too many questions, and such.” When reading this, it is easy to see where the old saying “Ignorance is bliss” originated. Based on these definitions, people who consider themselves anti-intellectuals are proud to be simple, semi-literate, anti-formal education, happy people that have a deep resentment of people who they believe are informed or educated. This would seem somewhat strange to a rational person. However anti-intellectualism has worked very hard at socially and culturally constructing many of our negative views and perceptions of intellectuals, education, and mathematics. There is no question that anti-intellectualism has evolved and is expressed in many forms of media not just literature, and its influence has been felt just about everywhere. Growing up I can remember falling prey to the anti-intellectual influence. Whenever I was successful academically, although I was praised by small number of people, I was confronted, ridiculed, and humiliated by the many who resented my success. In order to avoid these situations, I began to take an anti-intellectual view the world and avoid anything considered education.

What are the differences between intellectuals and anti-intellectuals?

According to Hofstadter (1962), “the case against intellect is founded upon a set of fictional and wholly abstract antagonisms” (p. 45). Nonetheless, all of the different anti-intellectualism movements have worked to create myths and stereotypes that reinforce and construct what many people consider the norm. However, these socially and culturally constructed views of intellectuals have been predominantly negatively very similar to that of Native Americans, African Americans, and other minorities. The question is why? So what are the differences between intellectuals and anti-intellectuals? In contrast to the intellectuals, anti-intellectuals place a higher value on feelings, emotion, and lived experience than they do on intellect and this is why many of their stories give the perception that “intellectual and cultural

pursuits ...[were] unworldly, unmasculine, and impractical” (Hofstadter, 1962, p. 34). As a major movement in American culture, anti-intellectualism tends to be hostile to anything considered intellectual. What I can't understand is why someone would oppose or be hostile to an approach or view that had been carefully thought out and reflected upon. I guess anti-intellectuals would rather base their actions on emotion or instinct instead of rational thought. They also formulated stories and myths that created the perception that if a person has intellect then they lack character. But why does intellect mean a lack of character? What character traits do intellectuals lack?

Where did anti-intellectualism come from?

Many people think that anti-intellectualism is something new in America; however, anti-intellectualism is very deeply rooted in American culture and society. Although anti-intellectualism has been present throughout many different historical, social, and cultural movements, Richard Hofstadter in *Anti-Intellectualism in American Life* (1962), describes the three major movements of religion, business, and populous politics in our American history where intellect was perceived as a vice and not a virtue. He also gives us some insight on how American institutions have and are continuously creating an anti-intellectualist atmosphere in our culture. It all started when settlers began migrating to the New World. The majority of the settlers were poor and uneducated but in many cases skillful workers. Many of the settlers had acquired the necessary knowledge or skills to make enough money to live, and did not see any value in becoming formally educated. Although churches and early schools taught people reading, writing, and simple arithmetic, the majority of the masses were illiterate. Most people in the New World who had been educated in a university or seminary, were considered intellectuals. However, since only a small minority of people were educated or considered

intellectuals, many were considered elite. Many of the commoners felt that the intellectuals had too much power over matters of politics, religion, and society and decided to work at gaining some of the power for themselves. In order to gain access to some power, the commoners formed a mass resistance against intellectuals and this resistance influenced what would later be called anti-intellectualism.

Populism

This anti-intellectual populism stressed that other than education level the commoners had as much ability and potential as an intellectual. The anti-intellectuals used their propaganda in an attempt to convince the masses that intellectuals have subversive opinions and views, lack national pride, moral clarity, and only use their knowledge and skills to con and manipulate the common people. Furthermore, if a person had to be educated to become a politician, then the numbers of people who would have access to power would be considerably lower, and if you were illiterate you had no chance of running for office. Therefore, one of the major tenets of populism is that the common or self-made-man should be the person to run the government. A self-made man was a person who was schooled by society and experience, and not from books. This political populism has been so successful that today the numbers of people considered intellectuals elected to public office is small. In order to keep the numbers of intellectuals in politics low, the anti-intellectuals claim that intellectuals are out to destroy democracy and egalitarianism and often use words like communist, socialist, liberal, or arrogant when describing someone considered informed or educated.

In *The Age of American Unreason* (2008), Susan Jacoby talks about how anti-intellectualism convinces the masses of these views through propaganda and misinformation. For instance, although the majority of intellectuals, who I know, have little to no influence in

political arenas, anti-intellectuals claim that intellectuals dominate academic and political discourse. For the most part, politicians have used intellectuals to serve their purposes and then kicked them to the curb like they do most of our veterans. People in power view intellectuals as a threat to their power because the intellectual may question or criticize and in doing so cause others to also notice the injustice inherent in their policy or policies. This type of insubordination just will not be allowed so anti-intellectuals consider intellect “a dangerous, subversive force in society, left free, there is nothing it will not reconsider, analyze, throw into question” (Hofstadter, 1962, p. 45). Although throughout most of our history anti-intellectuals have been the ones in political power and making decisions, they have managed to place the blame on intellectuals for most if not all of their misinformed idiotic decisions. This is why throughout most of our history being an intellectual has been perceived as a liability when it comes to politics and popularity trumps intellect almost every time.

Religion

Today many religious groups preach that education is a good thing; however, there was a time in the past where religious anti-intellectuals fought hard against education. They believed that if a person was to be able to read the Bible, they were educated enough. The evangelicals felt that the common man had a better understanding of the masses and hence could do a better job at preaching and reaching souls than the people who had wasted their time learning in the seminary. The religious anti-intellectuals created a legion of sayings, stories, and myths that have worked to influence and control the masses, many of which are still popular today. For example, according to Hofstadter (1962), evangelicals created the myth that “humble ignorance is a far better human quality than a cultivated mind” (p. 49) and “education or learning was a handicap to a person’s faith ...[because all education did was created people who were] morally corrupt”

(p. 309). These myths helped to give the anti-intellectual rhetoric legitimacy and convince the masses that their rhetoric was the norm. These myths and stories have worked so well that they are now deeply embedded in our culture and society. What is disturbing is the number of influential stories throughout our culture that relay these types of messages. For instance, the stories of Pandora's Box in Greek mythology and the Garden of Eden in the Bible both contain the message that all the problems of the world were brought about by curiosity and the search for knowledge. This is why today so many people believe that knowledge is a gateway to pandemonium, disaster, or the work of the devil.

Business

Another major movement responsible for the spread of anti-intellectual rhetoric is the American business movement. According to Hofstadter (1962), American businessmen “have brought to anti-intellectual movements more strength than any other force in society” (p. 237). In order to achieve their goals, they had to establish a way to control the masses and the intellectuals. However, they have flourished because “the business man is everywhere; he fills the coffers of the political parties; he owns or controls the influential press and agencies of mass culture. ...his voice dominates the rooms in which the real decisions are made” (Hofstadter, 1962, p. 235). This is very obvious today with all the corporate bailouts and lobbyists in Washington. Nevertheless the American businessman’s ultimate goal was to control not only their own businesses, but to gain complete control over all aspects of American society. That is why according to Peter Taubman in *Teaching by Numbers* (2009) educators

are subjected to a barrage of advice from individuals who have never taught, but apparently, because they went to school or made money or run a business, feel entitled to tell us how to teach, what to teach, and how to organize schools, classrooms, and

curricula. (p. 138)

Today big business is fully involved in education. For example, they create a curriculum that stresses business practices and skills and use the scientific management of schools as factories all in the name of efficiency. For example, “the language and practices of the learning sciences and the assumptions they make about learning and education have led educators to uncritically embrace discourses and practices imported from the business world” (Taubman, 2009, p. 160). Also, businesses make a tremendous amount of money on textbooks and standardized tests. According to Marla Morris in *Jewish Intellectuals* (2006), “the university, at least since the turn of the century, has been in cahoots with business and the military” (p. 207). Taubman’s book is a frightening example of anti-intellectualism and big business in full force.

Anti-intellectualism in Schools

One of the most ironic situations was the arrival of anti-intellectualism in our schools and the textbooks. From where I view the world, I can see that businesses are becoming closer to reaching their ultimate goal. The business models have made it into just about every facet of our society including our schools. For instance, as I read the chapter on Audit Culture, in Taubman’s text, I began to realize that anti-intellectualism and American business are now in control of education. They are now in control of knowledge. But more so, they are in control of how we come to view knowledge and education in general. This is not surprising since the businessmen own the major publishing companies and control the context of textbooks. Therefore, “the virtues of the heart were consistently exalted over those of the head, and this preference found its way into the hero literature of the school readers” (Hofstadter, 1962, p. 307). As I reflect on my early days in school, I can remember reading such stories and can also remember the many bad decisions I made as a result. I agree that the use of the heart can lead to a multitude of positive

results, but it has also given us teen pregnancy, underage drinking, rape, sexually transmitted disease, robbery, assault, murder and many of the cultural and social problems that we face today. These are some of the things you get when you think from the heart. Dane S. Clausson in *Anti-intellectualism in American Media: Magazines and Higher Education* (2003), describes how popular magazines and print media have been used to foster anti-intellectualism against higher education. He discusses how many of our politicians and presidents of major universities expressed concern that too many people were obtaining college degrees.

Anti-intellectualism in the Media

Furthermore, American business and anti-intellectuals have the ability to buy up all of the media outlets and can therefore shape every narrative, control the flow of knowledge, and shape our cultural and social views. They create these views for the purpose of controlling intellectuals by embarrassing them, disgracing them, and making them feel alienated and useless to society. They create the perception of intellectuals as insane bookworms, bastards, eggheads, nerds, geeks, and freaks just to name a few. For example, according to Hofstadter (1962), “the word intellectual became a synonym for the word bastard” (p. 295). They create negative stereotypes of intellectuals and use stories and myths to help reinforce and legitimize these images. For example, they started the myth that a formal education or academic schooling was useless because many businessmen were successful without the help of any kind of formal schooling. However, even though most businessmen were from advantaged families, there were enough self made men that the myth became believable anecdotally. Populism and American business helped to reinforce the traditional patriarchal myth that created the perception that politics was masculine and education made a person effeminate (Hofstadter, 1962, p. 50).

We see many of the anti-intellectual myths, stories, and stereotypes of the past continue

to be prominent and influential in our culture. These stories are told over and over again in movies, literature, comics, music, television, radio, newspaper, and the internet. Many of these stories have helped to promote an agenda against the acquisition of knowledge. In this way, knowledge could be readily available to all, but no one would want to seek it. What a unique form of hegemony. Although this study is to explore the influence of anti-intellectualism on mathematics and science, the one thing that must be made crystal clear is that anti-intellectualism does not discriminate between subjects or disciplines. For example, intellectuals of all types are considered socially inept, nerd, geek, genius, insane, effeminate, weird, and even stupid. However, when it comes to the subjects of mathematics or science, the anti-intellectuals increase their rethoric ten fold. For example, many businessmen believe “when applied to business, mathematics would lead to bankruptcy or the penitentiary” (Hofstadter, 1962, p. 304). American businesses are also aware that if they keep the masses uneducated they will always have access to cheap labor, and since they are in control of the schools and the media, they can make sure that we all stay dumbfounded.

Conclusion

In conclusion, we have seen throughout this exploration how the anti-intellectual movement has influenced our culture and society. This isn't hard to see when we are inculcated at such an early age. It is embedded in our textbooks. It is embedded everywhere. All of the anti-intellectual movements have been very successful in creating the impression that intellect is bad and have been so influential that today strains of anti-intellectualism have become woven into the fabric of our society and popular culture. This is why in the United States “academic and scholastic, instead of being titles of honor, are becoming terms of reproach” (Hofstadter, 1962, p. 380). This is why in American popular culture, negative actions with no regard for the

consequences is considered normal while being good in mathematics or science is considered abnormal or some type of mental illness. These views have functioned to create many of the stereotypes that depict people who are good in math as abnormal or freakish. Because of these stereotype, many people despise math and pretend to be bad in math and science in order to keep their popularity status and this contributes to the desire to be incompetent when it comes to mathematics. Why else would someone want to do math? If a person is good in math they must be insane.

Although anti-intellectualism has become a part of the American identity or DNA, anti-intellectuals are still working hard to maintain their dominance. Their rhetoric is still heard everywhere. They have packaged some of it differently, but it is still the same old thing. So until it is cool to be an educated and informed bastard, I am afraid that anti-intellectualism will continue to thrive. William Pinar (2004) warns us that “we cannot begin to respond to the displaced and deferred racism and misogyny we suffer today until we face the internalized consequences of our decades-long subjugation, namely a pervasive and crippling anti-intellectualism” (p. 9). Sowell warns that "the various skills of intellectuals can be used either to foster intellectual standards or to circumvent those standards and promote non-intellectual or even anti-intellectual agendas" (2009, p.10). Based on my previous social and cultural experiences, I would have to say that a majority of people in the United States are anti-intellectual, and as I reflect on these experiences and the previous definitions of anti-intellectualism, it doesn't take long to see that anti-intellectualism is alive, well, and flourishing in the United States. With the help of new technologies anti-intellectuals will be able to maintain, promote, and increase their influence on the masses.

CHAPTER 5

THE MEDIA IMPACT ON MATHEMATICS IN OUR SOCIETY AND CULTURE

According to Giroux (2002), in *Breaking in to the movies: Film and the culture of politics*, “mass media, especially popular culture, is where the pedagogy and learning take place for most young peoples, and as the primary pedagogical medium it cannot be ignored” (p. 52). Therefore, in this chapter, I wish to critically investigate the mass media and the role it has played in our social and cultural acceptance of mathematical illiteracy and innumeracy. For example, after considering what individuals or institutions have the most power in constructing, shaping, reinforcing, and legitimizing our social and cultural norms, I would have to say that the mass media is by far the most influential. Although our families, peers, and teachers have a great deal of power in shaping how we view the world, they too have been conditioned by the mass media. The mass media has the ability to reach large numbers of people through print, radio, television, motion pictures, and various other types of electronic or digital mediums. For example, according to Rasmussen (2005),

modern mass media ...[as well as] electronic mass media have the function of increasing the probability of communication which has been made improbable because of geographic distance, in that such media help determine and expand the sphere of receivers of any given communication. (p. 220)

According to Manovich (2001), “at least in principle, every point on earth is now instantly accessible from any other point on earth” (p. 172). The mass media has the ability to reach millions, if not billions, of people at the same time, and in contemporary society, there is almost no place a person can go to get away from the mass media influence. Therefore, as sad as it may seem, we are all products of a media environment.

The ability to reach large numbers of people at the same time gives the mass media the power to control any discourse and shape any narrative thereby shaping and controlling the outcome of about any issue, good or bad, true or false. However, Charles Pierce warns us in *Idiot America: How stupidity became a virtue in the Land of the Free* (2009) that “fact is that which enough people believe. Truth is determined by how fervently they believe it” (p. 43). He posits that if people hear a story enough times they will start to believe it, even though it is complete fiction. The actual truth is of no consequence and never comes into question. This is very problematic because the mass media has the power to reach large numbers of people who believe what they see in the news or read in a magazine or other types of social media. Therefore, the mass media can present events as common or the norm when they are only rare occurrences. Anecdotal events become statistical truth. People using this knowledge must be aware that they could be making decisions on facts that may be true, but are more than likely distorted or false. Although there will be people who are skeptical and question the truth of a story, their influence will be minimal compared to the sheer numbers of people persuaded by the media to believe it as fact. For instance, without the ability to reach large numbers of people quickly, it is difficult for the average person to introduce any contrasting views and this one sided relationship, according to Jacoby (2008) is why “the media provide the yeast, which, when added to other American social forces and institutions, creates a fertile culture for the spread of invincible ignorance throughout the public square” (p.17).

Therefore, throughout this chapter, I will explore how the mass media is being used as a means of social and cultural control continuously constructing popular culture politically, socially, and economically with the primary goal of advancing the capitalistic machine at all costs by manipulating and normalizing social and cultural norms that for many would seem

contradictory. For example, many times the media encourages people not to learn. But why? Education and learning are empowering and with an adequate knowledge of mathematics, probability, and statistics, and the ability to critically analyze different situations and scenarios, a person could make better educated and informed decisions. Furthermore, although most people believe that mathematical knowledge and ability are very valuable assets, the mass media infused with anti-intellectualism have functioned to reinforce negative social and cultural views concerning education and especially mathematics that shape how we as a culture view ourselves and our relations to learning. For example, today students feel as though the instruction they receive in schools is not relevant to their lives and in some cases this is true; however, most of these people have been conditioned by the mass media and our environment to feel this way. Many are fully consumed by, and acquire most of their knowledge from, the mass media and therefore the truth is what the media says it is, and that is why no schools in America can compete with the media industry in the education of the masses.

I will investigate and critically analyze the role that the mass media has played in constructing our historical, social, and cultural views and how with the use of what Lyotard (1984) calls grand narratives or meta-narratives have legitimized these views and existing power struggles. For example, we all come in contact with and are entertained by a wide range of stories or narratives of all types and genres. Nevertheless, these narratives, stories, or myths, true or false, construct particular points of view and are very powerful in constructing and shaping our social and cultural norms. Many of these narratives, stories, and representations convince people that they don't need to learn and create an atmosphere where people have no desire to learn anything, especially mathematics. The lack of desire to learn mathematics results in a lack of mathematical knowledge or basic numeracy which can be responsible for some of the most

oppressive outcomes associated with the issue. For example, we are constantly being affected by various media images, advertisements, and stories that are very powerful in creating desires, needs, and emotions. Although they can sometimes have a positive impact on our desires, needs, and emotions, Denzin and Lincoln (2003) warn us that “desire can be socially constructed and used by power wielders for destructive and oppressive outcomes” (p. 438). Furthermore, if we consider the world from a Freirian point of view, mathematical illiteracy and innumeracy are forms of oppression because a lack of these skills often function to restrict access and make it difficult to function in society. These negative views function to normalize and make legitimate our social and cultural acceptance of mathematical illiteracy and innumeracy.

People need to understand how our social and cultural acceptance of mathematical illiteracy and innumeracy enables the dominant hegemonic culture, mass media, and various anti-intellectual movements carry out their domination of the masses by shaping, creating, and reinforcing a culture where people are blind to their oppression and never realize how they are being misled or manipulated. Therefore, throughout this chapter I will argue that the mass media does indeed have the power to shape, influence, and control our thinking and actions as well as construct and shape our identities and our social and cultural norms. I will discuss how this control is carried out and for what purpose. I will critically analyze the role of the mass media in constructing and reinforcing our perceptions, attitudes, and stereotypes about schools, education, learning, mathematics, mathematics education, and people who possess mathematical ability, in order to determine what impact these views have on our motivation and desire to learn. How have these views created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate? Does the mass media have the power to control everyone? Throughout this discussion, I will consider many of the theories, ideas, and concepts

consistent with the Frankfurt and British schools of cultural studies as well as current research in media studies. I will discuss the influence of anti-intellectualism articulated with the mass media on a person's desire to learn anything, especially mathematics. However, some people have argued, and still argue, that the mass media can be used as a positive force in our society. Therefore, in concluding this discussion, I will explore the possibility of using the mass media in positive ways to change our current social and cultural norms concerning education and the learning of mathematics.

The mass media has the power to shape, influence, and control our thinking and actions.

Although there are some who would argue, I believe, as many others do, that the mass media has the power to shape, influence, and control our thinking and actions. For example, according to Lewis in *Cultural Studies: The Basics* (2006) many of the scholars from the Frankfurt School such as Theodore Adorno, Herbert Marcuse, Walter Benjamin, and Max Horkheimer believed that the mass media "with its capacity for the delivery of messages to mass audiences, was considered the principle agent of control and social conditioning" (p. 89). Many of the scholars considered the mass media or culture industry very dangerous. For example, according to John Weaver in *Popular Culture Primer* (2009), "the culture industry for Adorno and Horkheimer is nothing but neo-fascism that would make the Nazi head of propaganda Goebbels, proud" (p. 30). All of the scholars of the Frankfurt School witnessed firsthand how the mass media or culture industry could be used to control people's thoughts and actions.

From the beginning of film, many voiced concern that film could be used to control thinking. As early as "the 1920s, Eisenstein speculated that film could be used to externalize- and control- thinking" (Manovich, 2001, p. 58). Alfred Hitchcock believed "the audience is like a giant organ" (Gormley, 2005, p. 14) to be played by the filmmaker. He believed that if he

played certain notes, he could elicit a certain response; thereby manipulating the masses with media. Adorno and Horkheimer believed that culture and especially popular culture was “controlled and manipulated by the movie studio moguls” (Weaver, 2009, p. 29). The research conducted in trying to better understand how to use media as a means of control has resulted in what we call mass communications theory. For example, mass communications theory seeks to explain how mass communications affects us all and according to Vinson & Ross (2003), may be “traced to the earliest efforts of scholars in sociology, political science, psychology, psychoanalysis, and many other related disciplines.” Manovich posits that mass communications theory articulated with the mass media can definitely “externalize and objectify reasoning, and therefore can be used to augment or control it” (2001, p. 59).

The mass media has the power to shape our social and cultural norms.

Since the mass media has the power to control our thinking and actions, it should be obvious that they also have the power to shape and construct our social and cultural norms. For example, in 1958, Raymond Williams, a professor of English and literary criticism wrote *Culture and Society* which discussed how the media of the 18th, 19th, and 20th centuries controlled the direction of what we today call culture. In *The Long Revolution* (1965), Williams described culture as a particular way of life which expresses certain meanings and values in art, learning, institutions, and ordinary behavior. C. P. Snow in *The Two Cultures* (1998), defines culture as “a group of persons living in the same environment, linked by common habits, common assumptions, a common way of life” (p. 64). People who live in the same environment are influenced by that environment and this tends to create a unified outlook or common culture. Before the rise of mass media, social and cultural views were shaped and constructed locally or regionally. For example, people who lived in the same town, city, county, or state, tended to have

many of the same social and cultural views. However, according to Spring (2003), “in the early 19th century society, ...schools, newspapers, [the] national postal service, and advertising created a common culture among Americans mainly of European descent” (p.1). Today in the age of mass media social and cultural views are shaped nationally and globally.

Giroux argues that “films do more than entertain, they offer up subject positions, mobilize desires, influence us unconsciously, and help to construct the landscape of American culture...Films both entertain and educate” (2002, p. 3). Although filmmakers use films to teach values, ideas, and whatever else they consider the norm, they also use movies to test what we consider acceptable cultural and social norms. Films “represent a new form of pedagogical text – not simply reflecting culture but actually constructing it” (Giroux, 2002, p. 8). Television and film images are very efficient for cultural communication, “because they share many qualities with natural perception, they are easily processed by the brain. Their similarity to ‘the real thing’ allows designers to provoke emotions in viewers, as well as effectively visualize nonexistent objects and scenes” (Manovich, 2001, p. 180). This cultural communication is sometimes responsible for many of the fads we see in popular culture as well as the creation of various culture or subcultures. For example, in a conversation with my neighbor, he recalled how after the release of the film *Easy Rider*, “bell bottom jeans” became very popular. As he recalls, bell bottom jeans were around, just not popular until after the movie was released. Just think about all of the movies that have become cultural icons and their impact on normalizing and legitimizing our social and cultural norms. If seeing is believing, then it becomes very hard for people to distinguish between fantasy and reality. This is why cultural studies argues “the development of mass media has changed the way the culture operates. ...New forms of culture and cultural domination are produced as the distinction between real and the simulated is blurred” (Denzin &

Lincoln, 2003, p. 442).

According to Hall, “the media play a crucial role in defining our experiences for us... It is primarily through the press, television, film, etc. that experience is organized, interpreted, and made to cohere in contradiction as it were” (1998, p. 85). For example, many films reinforce the myths of American culture. For example, “these myths of the capitalist ethic, the rugged individual, the drummer who marches to his or her own beat, and the fairness of social institutions, help to conceal the structural sources of inequality and oppression in society” (Bulman, 2005, p. 159). Nevertheless, Americans

hold contradictory beliefs about individualism, inequality, education, and adolescence ...[and] believe that the individual is more powerful than society, yet we as individuals are dependent upon community. Inequality is considered to be both a social problem and a social necessity. (Bulman, 2005, p.163)

Although the truths of these stories, myths, or grand narratives are many times in question, they nevertheless construct how we see society, culture, and ourselves. In other words, these myths and folktales help shape our perception of the world and hide many of the contradictions associated with these myths. For example, “the success story of the American entrepreneur is the myth that illustrates the virtues of this capitalist ideology and the rules for the subject to follow” (Semmerling, 2006, p. 4). Although these successes could be considered anecdotal at best, these myths help to reinforce the ideology that capitalism is the best economic system.

Scholars such as Hall and Whannel (1964), McRobbie (1999), Jacoby (2008), and Sholle & Denski, (1994) understand the impact of the mass media in creating and shaping a common culture, as well as the multitude of subcultures. For example, Hall and Whannel investigated the effects of media on society and the youth subculture to explore issues of hegemony and cultural

studies. Their findings help give us some insight on the power of the mass media in constructing and reproducing a common culture and how the resistance to this reproduction creates many of our subcultures. *In the Culture Society* (1999), McRobbie discusses the ways that the media actively constructs popular culture as well as many of our subcultures. Jacoby (2008) posits “all of the driving social forces of the sixties – the counterculture, the counter-counterculture, and the popular youth culture – were stimulated by television” (p.173). According to Sholle & Denski (1994), “television is the most powerful tool for the reproduction and maintenance of the normative values of dominant culture ever known, ever imagined” (p. 8).

In Miller’s *Illustration* (1992), we see that “a world-wide culture of blue jeans and tee-shirts, film, television, video-cassettes, popular music on radio and CDs is irreversibly displacing, or at least transforming, local cultures everywhere” (p. 11). However, with the ability to communicate a message to a large number of people over vast distances at the same time, thereby increasing the size of the environment, the mass media has the power to not only transform local cultures but also global cultures. According to McCarthy (2007), C.L.R. James’ “was very mindful of the fact that these new social technologies are master instruments of cultural production” (p.138). As I reflect on my past experiences with mass media, I now have a better understanding of how the mass media is used to construct, shape, reinforce, and reproduce many of the values, morals, beliefs, and desires consistent with our social and cultural norms.

The mass media has the power to construct and shape our identities.

Since we have seen the power of the mass media in shaping and controlling our thinking and actions, as well as constructing and shaping our social and cultural norms, it should be clear that they have the power, both directly and indirectly, to construct and shape our identities. For example, from my personal experiences, I have noticed the power of the mass media in

transforming minds and imaginations and controlling how you view yourself and others, as well as the image or perception others have of you in society. Of course I never realized just how much until recently. For example, most people never realize the power of the mass media in constructing and shaping our personal identities, social identities, and national identity.

According to Giroux (2002), people need to know “how the existing generation of youth are being produced within a society in which mass media plays a decisive if not unparalleled role in constructing multiple and diverse social identities” (p. 57).

The mass media has the power to construct and reinforce many of our gender stereotypes which have a direct impact on our sexual identities. For instance, the mass media use the masculine myth to help reinforce the notion that men are rough and tough, the dominant gender and that “masculinity ...[is] natural, normal, and universal” (Semmerling, 2006, p. 129). For example, in most of the television shows and films that I watched as a young kid, a man would just about always be the hero who saved the day fighting evil and injustice, protecting others, and defending the honor of the women, and for a long time this man was always white. As a consequence of the masculine myth, many of Hollywood’s films portray the family as patriarchal, the men always in charge. It is the woman’s job to raise kids, do the laundry, cook, clean, and look fantastic. The man changes the oil, works on all of the mechanical stuff, and does the yard work. My grandmother, being a strong-willed woman and the boss in the family, helped me to see firsthand the contradictions evident in these myths. Nevertheless, because of these masculine myths, an association with being smart is not considered manly and this causes many male students to embrace anti-intellectual identities.

As I began to reflect on the role that the mass media has played in constructing my identity, I started to see its impact on the person I have become. From my years of reading

science-fiction or watching science-fiction movies or television shows, I developed a curiosity for math and science that helped increase my motivation and desire to learn and this has resulted in me having a positive mathematical identity. I can now see the influence that books, magazines, comics, television shows, and films have played in the construction of my identity and how they were very influential in constructing the way I view myself as an honorable, virtuous, and compassionate person who stands up for the weak and oppressed and fights for truth, justice, and what I feel is right. For instance, I can recall many of the tales of shining knights coming to save the day and how through intellect and perseverance a person could accomplish their goals. I suppose this is natural since “all non-comic genre films are based on the structure of the romance of medieval literature: a protagonist either has or develops great and special skills and overcomes insurmountable obstacles in extraordinary situations to successfully achieve some desired goal” (Tasker, 2004, p. 74). Nevertheless, I bought into this hook line and sinker. My brothers and I would often play cowboys and Indians, war, and sword fighting with sticks. We would put on capes and jump off the roof of our house. Although it was great fun, it was also very painful. We were constantly hurting each other by performing many of the wrestling moves that we had seen on television.

The mass media not only shape our personal identities, it also shapes our national identities by functioning to promote and increase our national pride. According to Giroux (2002), “the potency and power of the movie industry can be seen in its powerful influence upon the popular imagination and public consciousness. Unlike ordinary consumer items, film produces images, ideas, and ideologies that shape both individual and national identities” (p. 6). According to Semmerling, our national identity as a “nation that is a light of freedom, democracy, and enterprise in the world” (2006, p. 125) has been shaped by film. However, many of these films

function to create what Engelhardt calls victory culture. “Victory culture is the ideal American view of a national destiny that is victorious in the struggle against aggression (Engelhardt, 1995, p. 3). For example, the cowboy would always defeat the Indians or the outlaws and save the family, the farm, the city, or the town. He would always appear in the nick of time to save the day. Whenever good people were in trouble, he would always appear to save everyone. No matter the obstacles, from bullets flying everywhere to bombs exploding all around the hero always succeeded in coming through the incident with little or no injury. As I reflect on the notion of a victory culture, I try and think of the last time that I saw a movie where the Americans lose. I am certain that some exist, but I could not think of any. However, there are tons of media that show us as victorious and this impacts our individual and national identities. Although experiences with my family, friends, teachers, and schools have had a major impact on the construction of my identity, I feel that the mass media and popular culture have been the most influential.

How does the mass media use their power, and why?

Reproduction of the dominant ideology and culture.

Many scholars have suggested that the mass media use their power to reproduce the dominant ideology and culture, socially control the masses, and advance the capitalist system by creating a mass consumer culture. For instance, the mass media uses their power to reproduce the dominant ideology and culture by creating a unified outlook through the use of stories and myths for the purpose of reinforcing particular attitudes, perceptions, and stereotypes. According to Manovich, the mass media has the power to construct and reinforce the “same ideological beliefs ...[because they have the] ability to disseminate the same texts, images, and sounds to millions of citizens” (2001, p. 22). Because of their ability to reach large numbers of people quickly and

because their messages create a unified outlook among most of those exposed, the mass media is very influential in reproducing the dominant ideology and culture. For instance, up until the development of the printing press, most information was communicated orally and although oral communication is very powerful in shaping who we become and how we view the world, the impact or influence is minimal because it can only reach a relatively small number of people at any given moment.

However, the printing press made it possible to produce multiple copies of newspapers, magazines, or books and communicate information to a larger number of people, over greater distances in a shorter period of time. As with oral communication, people receiving similar messages through print media tended to have a unified outlook about society, culture, and the world in general. These unified outlooks in connection with the fact that according to Virilio in *War and Cinema* (1989), most people believe “what they read,” (p. 36) it didn’t take long for print media to become a powerful tool in the promotion of some ideological agenda. For instance, print media made it possible to promote the dominant ideology through narratives, stories, and myths designed to construct and reinforce a particular unified world view. Appelbaum warns us about how “ideology is ‘inscribed’ in discourses, myths, presentations, and re-presentations of the way ‘things are’.”(1995, p. 61). According to Freire (2004), “people are manipulated by the series of myths" (p.147) that convince the masses to conform to the dominant ideology or culture.

Just as people believe the information they read in books, many also believe what is presented on the radio and therefore, with the development of the radio the power to promote some ideological agenda or control how people perceive the world would increase substantially. People listening to the same radios shows tended to have a unified outlook and many of the

stories presented on the radio were designed for the purpose of reproducing the dominant ideology or culture. As with print and radio, many people seeing the same films tend to have a unified outlook, and believe what they see. In *Film as art* (1957), Arnhiem posits that “when large masses of people see the same programs a certain unification of outlook will result” (p.197). For example, there are some people who believe that many of the characters portrayed in film are real. For example, I know some people who believe there are Jedi knights among us. According to Bulman (2005), “Hollywood films convey elements of the dominant ideology in the United States” (p. 7). These films function to reproduce the dominant ideology by convincing the masses to see the world in terms of the dominant ideology or status quo.

As the media grew in power, scholars of the British School of cultural studies, such as Richard Hoggart, Raymond Williams, and Stuart Hall expanded the research conducted at the Frankfurt School. The work of the British school led to the formation of the Birmingham Centre of Contemporary Cultural Studies which is considered by many to be the one of most influential in the history of Cultural Studies. The Centre’s major areas of interest were in subculture, popular culture, media studies, and literary and historical theory. The theorist working at the Centre used many different disciplines, ideas, and methodologies consisting of Marxism, post-structuralism, feminism, critical race theory, sociology, ethnography, and phenomenology, as well as studied the effects of the mass media on their audiences. In 1968, under Hall’s directorship, there was a shift towards understanding how media helped to inscribe the ideas of the dominant society and impose their ideologies on masses. The Centre investigated the influence of popular culture on the masses and how this influence shapes our consciousness. They investigated culture and power in an attempt to uncover disempowering educational and social practices.

As the populous became more educated, we started to see the rise of more powerful ideological tools used to communicate messages to the masses. For instance, the dominant powers had to find better and more subversive hegemonic means to maintain control of the masses and with advances in technology and the age of mass communication this control would become possible. Just as with print, radio, and film most people believed the information coming from the television. For example, back in the 1980s the hit show Dallas had a character named J.R. played by Larry Hagman. J. R. was rich and powerful and was considered evil by many. Now remember that this was just a character on a television show. However, Hagman described in an interview that he would receive hate mail, death threats, and on some occasions was assaulted because of this character. In *Television* (2003), Raymond Williams describes how the introduction of television and its power as a medium was “so great that it altered all preceding media of news and entertainment . . . Inherent properties as an electronic medium altered our basic perceptions of reality, and thence our relations with each other and with the world” (p. 3). Because television could change our perception of reality and get masses of people to see issues collectively it became a major tool used for reproduction and control. If you can control perception, you can control the people. Williams considers broadcasting to be a “powerful form of social integration and control” (2003, p. 16). He believed that broadcasting would serve “as a form of unified social intake, at the most general levels” (2003, p. 21).

People need to understand that the film and television industry spends large amounts of money on psychoanalysts and behaviorists in order to create the intended impact. Although many of the masses believe that television shows and films have no influence over them, the Hollywood studios believe otherwise. Hutchings in *The Horror Film* (2004) suggests psychoanalysis “has become widely disseminated in western culture to the extent that many

people- including film-makers – will be familiar with concepts and practices associated with it” (p. 58). They used and still use all types of psychological and psychoanalytical tools with the intention of influencing people. When it comes to television and film, I can attest to their power to influence because I have experienced it firsthand. For example, I remember spending my summers at the beach with my family. My brothers and I would swim and surf in the ocean all day every day. I never considered these activities to be dangerous. Nevertheless, after seeing *Jaws*, I remember being scared to go into the water at the beach. And when I did go in, it was with much apprehension. I can recall how the 3D movies influenced the entire audience when the monster would reach out and everyone in the audience would jump back.

Socially Control the Masses

The mass media also uses their power to socially control the masses by spreading propaganda and misinformation meant to manipulate and create particular points of view. Freire enlightens us on how this control is carried out using what he calls the “arms of domination,” manipulation and propaganda (2004, p. 68). Noam Chomsky in *Media control: spectacular achievements of propaganda* (2002) posits that propaganda enables “the manufacture of consent” (p.18). Therefore, this control is carried out by using the mass media and broadcasting as an outlet for propaganda meant not to entertain but for the sole purpose of manipulating and controlling the masses. Not only does the mass media use propaganda to convince the masses of particular points of view, they also use stories and myths to reinforce attitudes, perceptions, and stereotypes. The mass media has used many techniques to control the masses ranging from propaganda, junk science, pseudoscience, misinformation, and manipulation, they have become experts in divide and conquer to the point that no one can perceive their strategy to divide. For example, “since it is necessary to divide the people in order

to preserve the status quo and (thereby) the power of the dominators, it is essential for the oppressors to keep the oppressed from perceiving their strategy” (Freire, 2004, p. 146).

After World War Two, we began to see newer and more efficient types of media used as a form of social control. History shows us that if you can control what people think, you can control the people, and with the onset of new technologies this control would become easier than ever before. The mass media have been notorious for manipulating the masses through misinformation and propaganda. For example, the mass media often uses propaganda infused with junk science or pseudoscience to manipulate and control people because they understand that most people do not have the basic scientific and mathematical backgrounds necessary to critically analyze and assess the validity of the media claims, many of which are false. Nevertheless, the media understands that if the masses hear it, read it, and see it long enough, they start to believe it no matter the truth. Furthermore, propaganda has a unique way of changing people’s perceptions and in today’s media driven world, perception is far more powerful than reality.

By using misinformation and propaganda, the mass media carry out a divide and conquer strategy that creates conflicts between different groups, so these groups will never notice their oppression. For instance, according to Chomsky (2002), propaganda is used to keep the “bewildered herd ...distracted” (p. 19). Friere (2004) warns us that the oppressors will create conflict in different groups in order to keep these groups distracted so they never realize their oppression. This continued conflict leaves no time for people to meditate or reflect on their situations. Therefore, by creating conflict, the mass media can more easily maintain social control. For example, the media tries to construct an ‘us against them’ theme to get people of all different groups to believe that the media is on their side. They try and use symbols, music, or

movies that protest the status quo in order to sell products or services to all of the people fighting and resisting their present situation. They try and play off of the emotions present in the resistant population. For example, Reynolds (2004) thinks that it is very interesting that advertising jingles are now made up of the music that originated with social protests (p. 24).

The mass media has also been responsible for creating a generational conflict that portrays adults as stupid, callous, and corrupt to the younger generation. One such example of the generational conflict is a Capital One commercial that shows parents trying to take their kids on a snow skiing trip but their frequent flyer miles are blacked out during the skiing season. However, the parents decide to go to the mountains out of season. The parents are portrayed as idiots as they are seen snow skiing and driving snow mobiles down the side of a dirt hill in the summer. The boy of the family has a look of disgust on his face because of his parent's ignorance and says "what's in your wallet," implying that his parents are cheap which makes them not good consumer citizens. The kids believing that their parents are idiots or morons of the capitalist system show their full conditioning of a capitalist society. This gives the implication that the kids are better suited to exist in a capitalist consumer society than their parents. The kids feel that they are the kings and queens of the capitalist system and that they know how to better live and thrive in the present system than people of the older generation. This creates the facade that kids are better than the last generation and hence there is no need to respect those older obsolete consumers. Hence, this commercial is obviously advertising for the right company, "Capitalist" One.

The mass media have been responsible for creating and reinforcing many of the racial conflicts of the past and present. For example, many of the issues we have concerning race have been stimulated and exacerbated by the corporate media in order to keep us in fear, divided, and

in conflict thereby guaranteeing the status quo. According to Taubman in *Teaching by Numbers*, fears of black violence, fears that an unequal distribution of resources was favoring minorities, fears that schools, in an effort to cater to kids of color and immigrant children, were 'dumbing down' the curriculum and not emphasizing basic English. These fears, as well as fears provoked among the Black population, for example, fears that their children were not competitive with white students and might be economically left behind, fears that had previously been understood in terms of institutional racism and the class structure, were exchanged for the more manageable fear that teachers and teacher educators were not measuring up. The way to address these fears was not through combating racism or class inequalities or the excesses of the market but through holding these various groups, as groups and as individuals, accountable for their failure to meet specified standards. (2009, p. 106)

It makes it very difficult to solve many of our racial problems, when we are inundated night after night by media coverage of African Americans involved in some type of criminal activity or being killed by police.

The mass media are very skilled in the art of creating the 'other' in order to produce conflict between different groups. For instance, they have created negative views and perceptions of South Americans, Asians, Native Americans, African Americans, and during this time period in our history, any person of middle-eastern ancestry. For example, films that portray Arabs as evil villains create stereotypes that encourage people to be suspicious of all Arabic people. However Chomsky warns us “the picture of the world that’s presented to the public has only the remotest relation to reality” (2002, p. 37). However, according to Denzin and Lincoln (2003), “we increasingly make sense of the social world and judge other cultures through conventional

and culture-bound television genres” (p. 455). The problem is according to Manovich in *The language of new media* (2001), “as is the case with all cultural representations, new media representations are also inevitably biased. They represent/construct some features of reality at the expense of others, one worldview among many, one possible system of categories among numerous others” (p. 16). We see it every night on the different news shows. If a person watches a story on one network and then turns the channel to watch the same story on another network, they could see totally different viewpoints about the same event.

Furthermore, I can remember watching television shows or movies and walking away feeling a deep hatred for the Germans, Japanese, or anyone portrayed as an enemy. However, I was not around during World War II and had never known any people other than Americans. During the cold war, all we heard was how the Soviet Union was our enemy and that we should fear them and be willing to kill them. However according to Chomsky “to whip them up you have to frighten them” (2002, p. 30). Here Chomsky is talking about how the mass media was and is used to create fear in order to persuade the population to participate in acts of war, genocide, or any other despicable act they feel is in their best interest. I can remember, on several occasions, the joy that I felt from watching James Bond defeat the Russians. However, one of the most disturbing things is today I know quite a few people from Russia, Germany, and Japan and I find myself asking the question why did I hate these people? What did they ever do to me? However, it is here that I see the power the mass media has in creating these perceptions and points of view.

As we look back historically, there are many examples of people being influenced and controlled by the mass media. For example, during the early to middle twentieth century the entire world witnessed Hitler and the Nazis use mass media and propaganda to manipulate,

dominate, and control an entire country. In Virilio's, *War and Cinema* (1989), he discusses some of the feelings that the Nazi leaders had about propaganda as well as how war and cinema both used perception to gain power and control of the people. For example, Virilio states that

weapons are tools not just of destruction but also of perception- that is to say, stimulants that make themselves felt through chemical, neurological processes in the sense organs and the central nervous system, affecting human reactions and even the perceptual identification and differentiation of objects. (1989, p. 6)

According to Kilbourne (1999), Goebbel's definition of propaganda had a lot of similarities to Gramsci's hegemony. For example, "those who are to be persuaded by it should be completely immersed in the ideas of the propaganda, without ever noticing that they are being immersed in it" (Kilbourne, 1999, p. 64). Although the Nazis thought that they were the only ones who could use misinformation and propaganda as a weapon, there were many other countries who used these methods very effectively. For example, Benito Mussolini declared "propaganda is my best weapon" (Virilio, 1989, p. 53). According to Chomsky, "propaganda is to a democracy what the bludgeon is to a totalitarian state" (2002, p. 20).

Hitler and the Nazis used many different types of media to manipulate and control the masses. For example, Goebbels "sent fifty thousand fascist propaganda records to gramophone-owning households and forced cinema managers, often under threat of violence, to screen ideologically loaded shorts" (Virilio, 1989, p. 24). Understanding the power of the media, Hitler formulated a plan to use movie trailers as a means of manipulating and brainwashing a nation. With great efficiency, he used every trick in the book, including film, radio, print, and physical force to push his ideological message. In *Television* (2003) Williams states "the only developed 'mass' use of radio was in Nazi Germany, where under Goebbels' orders the Party organized

compulsory public listening groups and the receivers were in the street” (p.17). Hitler inundated his entire country with continuous propaganda meant to manipulate and convince people of his ideological point of view. It didn’t take long for him to control almost everyone in the entire country, including intellectuals. Although each country has used mass media differently, today most countries still use mass media as a means to control, to teach, and to assimilate the masses. They understand how to use their power in creating a hegemonic mass consciousness as a means to dominate and control, by convincing the masses to believe what the dominant power want them to believe without ever knowing the truth, or noticing how they are being conditioned and controlled. Grossberg in *History, Politics, and Postmodernism* (1996), reminds us that “hegemony is not a universally present struggle; it is a conjunctural politics opened up by the conditions of advanced capitalism, mass communication, and culture” (p.162).

Mass Media as a tool to advance capitalism

We have seen how the mass media has been used to shape people’s identities and minds to the norms of our society and culture. However, not only do these hegemonic powers want to control and reproduce the masses, they also want to promote and advance capitalism. For instance, a capitalist system requires its citizens to work for a wage, so that they can buy goods and services. Therefore, for a capitalist system to survive and flourish, it needs a means to convince the masses to buy into the system and spend, spend, spend on things that they many times don’t want and don’t need, with money they don’t have. A capitalist society needs to create what Spring (2003) in *Educating the consumer-citizen* calls a mass consumer culture that integrates consumerism into all aspects of life from birth to death, including, but not limited to, education, leisure time activities, the popular arts, the home, travel, and personal imagination. Mass consumer culture captures the fantasy world of people with

brand names and fashions that promise personal transformation, the vicarious thrill of imagining the glamorous lives of media celebrities, the promise of escape from hard work through packaged travel and cruises to an envisioned paradise, and the idea that in America everyone has an equal opportunity to consume. (p. 2)

In a mass consumer culture, the goal is to produce consumer citizens who are willing to buy and accept “any political situation as long as there is an abundance of consumer goods” (Spring, (2003, p. 4). This is dangerous for our democracy because the mass media uses propaganda to socially and culturally construct consumers that typically never question their current situation.

We’ve seen the power of the mass media in shaping and constructing our culture and society. Therefore it is not outlandish to suggest that the mass media has the power to shape and construct a mass consumer culture. Mass communication can construct and shape a common culture and “advertising creates a consumer culture” (Weaver & Daspit, 2003, p.146). Therefore these two forces combined have the power to create a mass consumer culture. The relationship between mass communication and advertising began in the age of newspapers. For instance, newspapers represent an early form of mass communication which was funded by the sales of papers as well as advertising. For newspaper companies trying to function in a capitalist society, advertising was the goose that laid the golden egg. As more and more newspaper organizations popped up, competition was fierce and, the number of papers sold was directly related to advertising dollars. Most companies, in order to increase their profit margins, would buy advertising space only in the papers that sold the most copies. I guess if you are an advertiser, that makes perfect business sense. Therefore, the primary goal of the newspapers were to sell papers because the more papers a news organization could sell the more money they could make from advertising.

The owners of these newspapers noticed that when the headlines contained sex, violence, and drama more papers were sold. The problem was if valid stories were unavailable, a fictional story was made up in order to sale more papers. Some of these stories were outright lies and some were just serious distortions of the truth. Although there could have been people who questioned the truth and validity of such stories, they had no means of reaching enough people to change the mass perception already created by the media. Hence, the more outrageous a story, the more profit the paper could make. If it meant distorting the truth or outright lying, the papers would do it for the sake of profit. Thereby creating an environment where money and profit trump the integrity of most news organizations. As technology advanced, the radio emerged as a new tool for advertising, and as the radio stations constructed programming that attracted larger and larger audiences, “ads on children’s radio programs provided fertile ground for training future consumers” (Spring, 2003, p. 118).

Although the mass media, I believe, has more power than any other social institution in creating, shaping, and influencing our mass consumer culture, I agree with Spring that public education is also guilty of producing good consumer citizens. Isn’t that the primary reason we have schools. Nevertheless

educators worried that the crass commercialization of privately operated radio would subvert American culture, ...[while] the radio industry claimed that commercial programming fostered a democratic culture by allowing listeners to vote for the type of culture they wanted by turning the radio knob to their favorite programs. (Spring, 2003, p. 115)

The listeners determined what programs would be successful as well as what programs would be unsuccessful. Although many educators believed in the power of radio as an educational tool,

others began to notice how the radio stations had started to compete with schools for the control and reproduction of the masses and were disturbed about how radio had taken over their jobs of cultural and moral instruction. For example, some stations allowed educators to develop educational programming; however, other stations thought that educational programming would not draw a large enough audience to be profitable. Therefore, it was becoming increasingly obvious that the technology of the radio was to be used to advance the capitalist system, make money, and not to help education. Film is also guilty because in America today, film is big business and many of the studios understand that sex and violence sell movie tickets, and of course, they try to make these types of movies, not for the entertainment or educational value, but because they think these films will make the most profit.

With the emergence of the television, we see a new and more powerful tool to promote capitalism and a mass culture. According to Vinson and Ross,

mass culture ...imposed on 'the masses' by corporate economic powerhouses ...an 'artificial' creation ...used to produce and maintain markets ...[and although] it exists ostensibly to provide entertainment, it is in fact more insidious, working subtly and seductively to manipulate consumer demand, sell products, promote power-laden ideologies, and boost profit margins. (2003, p. 28)

Williams (2003) states

the 'commercial' character of television ... [has been seen] as the making of programmes for profit in a known market; as a channel for advertising; and as a cultural and political form directly shaped by and dependent on the norms of capitalist society, selling both consumer goods and a 'way of life' based on them, in an ethos that is at once locally generated, by domestic capitalist interests and authorities, and internationally organized,

as a political project, by the dominant capitalist power. (p. 36)

As television air time and the sizes of the audiences increased, mass communication theories helped to create methods that would increase the manipulation and control of the multitudes of consumer citizens.

This is why corporations spend more and more advertising dollars trying to influence kids and adults to buy. As television became a major part of our daily diet, people were inundated with images and commercials. “Remember always that in capitalism all a body has to do is desire-and subordinate its desiring to earning and consuming” (Reynolds, 2004, p.30) and the mass media articulated with capitalism are very powerful in creating a desire to consume. Advertising prompted desires for new products which helped to maximize profits, and “the advertising profession transformed the capitalist model of buyers making rational choices in a free market into a consumerist model where the buyer was driven by irrational emotions associated with particular brand names and/or products” (Spring, 2003, p. 2). Hence, as the ideas of marketing and control began to gain more ground, technology brought us more advancements that would be used to increase the commercialization of the media, television, and movies. Hence we see the articulation of social control and the capitalist machine, one feeding on the other in a sea of hegemony. Because of media’s capitalist interests, advertising became a mainstay in the public sphere. Advertising gave radio and television stations a way to make money and according to Williams, became “the feature around which radio and television were organized, as well as the main source by which they were financed” (1974, p. 66). “Through radio and TV, Americans learned to accept a commercialized fantasy world where products were inseparable from entertainment” (Spring, 2003, p.124). Not only did the media want to push mass consumerism on people, it wanted to make sure that the addiction it produced would be too

strong for the masses to overcome. Hence, the media became a source of guaranteed hegemony. “Schools, advertising, commercial media, and public relations campaigns created a spontaneous association between consumption and the American way of life” (Spring, 2003, p.125).

Advertisers play on the fact that people are not educated enough to critically evaluate advertisements. If the masses were able to better understand and evaluate the information presented in the ads, then advertisers and marketing would lose some of their power to manipulate which would give advertisers motive to make sure most people remain mathematically illiterate and innumerate. They manipulate and corrupt as well as control the masses to create a feeding frenzy of capitalism. They construct a big lie in order to sell, sell, sell to ‘the sucker born every minute’ and without the necessary mathematical background, a person can easily be the sucker. According to Kilbourne in *Can't buy my love* (1999), “democracy itself is endangered when information is given to foster private economic gain rather than to educate and enlighten the public so it can make intelligent decisions” (p. 307). We have seen how the tobacco companies used misinformation for capitalist gain. By doing this, they placed their economic gain over the safety and welfare of people’s lives. Therefore, many smokers were never given the facts which took away their right in making intelligent decisions.

According to Kilbourne, most people feel that advertising has no influence on them. However, Goebbells has made very aware,

the most effective kind of propaganda is that which is not recognized as propaganda.

Because we think advertising is silly and trivial, we are less on guard, less critical, than we might otherwise be. It’s all in fun, it’s ridiculous. While we’re laughing, sometimes sneering, the commercial does its work. (Kilbourne, 1999, p. 27)

Kilbourne informs us that advertisers pay enormous amounts of money on psychological

research in order to influence the consumer. This research is conducted on adults and children alike, and because of this research advertising and marketing have made

concurrent advancements in their ability to construct increasingly elaborate demographic and psychographic portraits of media audiences. More directly, these technologies led to tremendous advancements in the techniques of film and video production, creating a cottage industry in computer driven special effects that increasingly amaze, stun and narcotize entertainment audiences (while blurring the distinctions between news, entertainment and advertising). (Sholle & Denski, 1994, p. 55)

For example, “advertisers, especially those who advertise tobacco and alcohol are forever claiming that advertising doesn’t influence anyone, that kids smoke and drink because of peer pressure” (Kilbourne, 1999, p. 40). Yes peer pressure is a powerful influence; however, I do not feel that it is as powerful as the mass media.

Remember in the early years of the movies smoking was glamorous therefore many people looked at smoking as a status symbol. If you smoked, you were considered cool, part of the in crowd. However, “Americans rely on the media for our health information. But this information is altered, distorted, even censored on behalf of the advertisers” (Kilbourne, 1999, p. 53). As Paulo Friere reminds us, the powerful want to remain in power and will do anything, at any cost, to keep it no matter the consequences. They will use misinformation and lie without any restraint, especially for monetary gain. Morals and ethics have no place in making money and the primary purpose of mass media is to deliver us to advertisers. “Much of the information that we need from the media in order to make informed choices in our lives is distorted or deleted on behalf of corporate sponsors (Kilbourne, 1999, p.75). However, in a mass consumer culture, wealth is equivalent to power because money and assets are typically related to the

amount of power and access a person may possess. Money is truly the root of all evil. “Corporate wealth monopolizes debate, corrupts politicians, and dictates policy” (Kilbourne, 1999, p. 311).

Does the mass media have the power to control everyone?

Although the mass media may push the ideology of the dominant social group on the masses, it doesn't have the power to control and reproduce everyone. There are people who resist this control because according to Fiske (1996),

Stuart Hall respected people who resist because despite more than a century of economic, political and ideological domination, they are still active and kicking: they still make it difficult for hegemony to work, they still maintain an uncomfortable and unaccommodating variety of social identities despite the powerful political and economical attempts to homogenize them. (p. 219)

Just as some people resist hegemonic reproduction, they also resist becoming pawns of the media environment. For many who resist, they find ways to combat the media influence and many times this leads to the creation of subcultures. For example, in *Subculture* (1979), Hebdige discusses how subcultures are formed as a means to rebel against the norms of the dominant society and how

in highly complex societies like ours, which function through a finely graded system of divided (i.e. specialized) labour, the critical question has to do with which specific ideologies, representing the interests of which specific groups and classes will prevail at any given moment, in any given situation. (p.14)

Therefore subcultures are constructed to challenge becoming reproduced by the dominant culture and are systems of resistance, fighting for space and freedom in a world of hegemony.

If we consider Stuart Hall's reception theory, and the postmodern tenet of multiple

interpretations of an experience, we gain a better understanding of why at this point in human history the mass media does not have the power to control everyone. Nevertheless, these theories help shine some light on why some people enjoy math and science and therefore work hard at becoming mathematically literate and numerate and some people hate and despise anything they consider mathematical. For instance, since each person may create a different meaning from the same experiences, the producers of mass media cannot predict the outcome of their programming on our societies psyche. As Hall began to think about the many ways people read, receive, and interpret books, films, music, and popular arts, he developed his reception theory which helps to explain why people may have the same experience but their perceptions of the experience are different. He discusses this theory in *Encoding and decoding in the television discourse (1973)* and *Encoding and decoding (1980)*. These texts show that the producer of a text, message, advertisement, or some type of media, may expect a particular response, but the consumers may decode the media differently than expected, thereby having an unintended effect.

But what determines the type of response? What determines how the media is decoded? According to Daspit and Weaver (2000), "critical pedagogy addresses the potential for multiple readings of popular cultural texts, the contradictory and shifting meanings of texts, and the shifting power struggles over control of texts" (p. xiv). Critical pedagogy acknowledges the complexity in trying to determine the meaning of any particular text because there can be an infinite number of interpretations and these interpretations can be constantly changing. Hall believed that when people come in contact with some kind of media, they aren't just passive consumers, but are actively involved in making meaning of the experience. His "notion of 'preferred reading' suggests that audiences will select a particular meaning from a text depending on their social position and the ways in which they relate to the culture" (Lewis, 2006,

p. 263). According to Denzin and Lincoln (2003),

dominant and subordinate cultures deploy different systems of meaning based on the forms of knowledge produced in their cultural domain ...[and that is why] popular culture, with its TV, movies, video games, computers, music, dance, and other productions, plays an increasingly important role in critical research on power and domination. (p. 442)

When considering why some people may interpret the same experiences differently, these views help us gain some insight into how people bring previous experiences with them that help them to construct the meaning of new experiences. This could help explain why some people have positive experiences in a mathematics classroom and some have negative experiences as well as give us ideas at creating all positive experiences. Nevertheless, there could be an infinite number of interpretations and representations and because we all perceive experiences differently, Hall argues that the mass media, psychologist, and behaviorist will never have total control over the masses.

The mass media's role in constructing and reinforcing our social and cultural views of mathematics, mathematics education, and people who possess mathematical ability.

Throughout this discussion we have seen the power of the mass media to control our thinking and actions as well as shape and construct our identities and our social and cultural norms. With this in mind, I now wish to discuss the role of the mass media in constructing and reinforcing our social and cultural perceptions, attitudes, and stereotypes associated with mathematics, mathematics education, and people who possess mathematical ability. These views seriously impact our motivation and desire to learn, and have created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate. My argument is

the mass media has an enormous amount of power in shaping what people think about education and schools, and articulated with popular culture are notorious for constructing and shaping negative attitudes and perceptions of mathematics, teachers, learning, and schools. Since the mass media and popular culture play such an influential role in constructing these views, it is important that we critically analyze this influence.

Appelbaum argues “that popular culture is an important force in shaping how students, teachers, and others view themselves and their relations to various forms of teaching and learning” (1995, p.108). For example, according to Bulman, without “firsthand knowledge about particular schools ...the American public’s estimation of the public schools in general is based upon what they hear in the media” (2005, p. 54). Although there are certain degrees of truth in how the media portrays schools, most of the time these representations are wildly exaggerated or fictional, and typically very negative. Nevertheless, the media’s representation of the school, true or false, becomes how schools are perceived in society. The issue is most media including films, television shows, and songs about high school, or school in general, create a negative image or negative attitude about school or learning that seriously impacts our desire to learn. Many of these images of school, learning, or mathematics, have created an anti-intellectual environment which makes teaching very difficult. Therefore Dasplet and Weaver (2000) suggests that we “incorporate cultural studies into our understanding of schooling not only to address how students read themselves but how they, along with teachers and administrators, read popular culture texts in general” (p.xiii). How do popular culture images shape our views of mathematics? What do these images have to do with how mathematics and mathematics education are portrayed and what are the consequences? How does the mass media shape us and influence us as viewers? “How might popular culture reconfigure the meaning of schooling, the

role of the teacher, and the message of the critical theorist?" (Daspit & Weaver, 2000, p. xxix).

In an attempt to answer many of these questions, I will critically analyze various films and discuss their impact on mathematics and mathematics education.

Stand and Deliver

The first film that I'll consider, *Stand and Deliver*, is one of my all-time favorites. *Stand and Deliver* is a 1988 American film based on the true success story of high school mathematics teacher Jaime Escalante played by Edward James Olmos. Escalante is a wisecracking Bolivian, teaching at James A. Garfield High School in Eastern Los Angeles. When Escalante first arrived at Garfield in 1974, the campus was a wreck, gang infested, and totally out of control. Many of the teachers were scared each day for their lives or the lives of their students. Because the student population was made up of mostly Hispanic students from poverty stricken or working-class families who are way below their grade level in terms of academic skills most of the faculty at the school feel as though teaching these students is a waste of time and effort because the students have no desire or ability to learn. Therefore the faculty are very cynical that Escalante can teach his students anything, much less calculus. Mathematics is portrayed as a difficult subject. This shows how some teachers fall prey to stereotypes that influence how much time, effort, and encouragement they are willing give to each student. The film makes teachers look weak and unsympathetic to students. It portrays teachers as quitters who could care less about students, and that students should be in direct opposition.

The feelings of the faculty helped to solidify the self-images of many of the students as inferior. These feelings of inferiority were so strong that when Mr. Escalante told his students that he was going to teach them enough to pass the AP Calculus exam, the students did not believe him. Most of the students had given in to the self-fulfilling prophecy that they didn't

have the ability to do math. The school culture is terrible; therefore, Escalante attempts to help his students succeed academically by first changing the culture. Although most of his students are undisciplined, rebellious, and unmotivated, he feels that if he can change the culture he can motivate students to learn. The film makes it seem cool and safe to be anti-intellectual and rebellious. Escalante begins by concocting various means to change these views and uses many different methods to get his class to pay attention. For instance, on one occasion he shocks his students into paying attention by dressing up as a cook and chopping up apples with a meat cleaver. He uses some of the ideas and concepts of culturally relevant pedagogy by using the student's Mayan cultural heritage in mathematics as a source of pride to help encourage and motivate them to learn by telling the story of how the Mayans developed the concept of zero and assigned it a symbol before many of the other ancient civilizations.

Students depicted in the film had to deal with many of the social problems that still exist today. Especially those who consider education uncool and useless. Many students have developed an oppositional collective social identity and fictive kinship that convinces them that education is a bad thing and functions to reinforce negative perceptions of school, education, and mathematics. According to Fordham and Ogbu (1986),

The perception of schooling as a subtractive process causes subordinate minorities to

'oppose' or 'resist' academic striving; both socially and psychologically. At the social level, peer groups discourage their members from putting forth the time and effort required to do well in school and from adopting the attitudes and standard practices that enhance academic success. (p. 183)

Most of the students in the film oppose or resist the idea of having to go to school. However, people watching the film may interpret the student's reactions as the norm and also develop an

opposition and resistance towards going to school or learning mathematics.

One of the characters in the film *Angel*, was portrayed as a rough and tough, hard-core gang banger, who wanted to learn mathematics but went above and beyond to make sure that none of his friends or peers knew about his desire to learn. Angel knew that if anyone found out that he was studying mathematics, he would no longer be cool, he would lose his street credibility, and he would probably be ridiculed, harassed, or even assaulted. However Angel bought into what Mr. Escalante was selling and made the decision to learn calculus. To do this, he formulated a coping strategy for dealing with the possible peer pressure he may face if his secret were discovered. To keep his secret hidden, he kept multiple copies of textbooks. For example, he did not want his peers or people out on the street to see him carrying books because that would be bad for his image. He believed that if anyone saw him with a book, they would perceive him as weak. As was explained to us by Fordham and Ogbu (1986) in chapter 3, Angel wants to learn and wants to become educated, he just doesn't want his friends to know.

When students pass the exam, many at the testing service claim that they were cheating because students from their respective racial or economic backgrounds have never passed in such great numbers. However Escalante convinces the testing service to let his students take the test again and if they pass this time it should show that the students never cheated. Although some people will interpret this as a win for the underdog, a win that could encourage some students to believe in their ability when others don't, others interpretations may reinforce the idea that minorities are inferior academically in some way and the only way they can pass any kind at standardized test is to cheat. As with any other movie portrayals about school, they make it look easy. For example, they make it look like the students worked for a few months and then passed

the test. It is true that Escalante promoted a summer session, however, the real students needed years of preparation to pass the test.

James Escalante is a prime example of a good teacher and this film inspired teachers throughout the world to copy his methods. However I consider him somewhat authoritarian using traditional methods of rote memorization and drill and practice as the means for learning. However, it doesn't take long for this type of learning to seem like work. Therefore, students may require a teacher with the ability to motivate. The problem with traditional methods is that very few teachers can use these methods effectively. For example just because Escalante was able to get results using traditional methods does not mean that other teachers using the same method will be successful. He changed their previously constructed views of mathematics and taught his students how to take pride in their hard work and accomplishment and therefore influenced his students in positive and profound ways. He was very successful in motivating and encouraging his students to learn using traditional methods and continuously reinforced the importance of hard work. "When Escalante left, even though the same methods were used, scores plummeted" (Taubman, 2009, p. 85). This was because "Escalante was more than a teacher, he was an artist and an entertainer. For example, Escalante persistently chides students into attending to the lesson, shocks them by loud butchering of apples, and incorporates multiple forms of showmanship" (Appelbaum, 1995, p. 83). Not only does this film give us a look at how rough the schools are in East L.A., it also helps to encourage us that with perseverance and hard work students can successfully learn just about anything, especially mathematics. Although this film does reinforce and encourage anti-intellectual attitudes towards mathematics and education, it does give us hope that anything is possible and helps persuade us that motivation and hard work are the keys to success and can trump previous educational or social disadvantages.

Hidden Figures

After watching the film *Hidden Figures*, I was disturbed that it has taken all of these years for this story to finally be told. As a kid I was a NASA junkie and thought that I knew everything about the beginning of NASA and the people who worked on the missions. I thought that I had an extensive knowledge of the organization. However, I never knew about the role of the computers or the role that white or black women played in NASA's success. As I reflect on my experiences of growing up in the late 1960s, I realize that in the early years of NASA their image was that most aspects of spaceflight, the engineers, the scientists, the mathematicians, and the astronauts were a man's work. Although I do remember that NASA was made up of people of many different backgrounds, walks of life, race, and gender, I don't really remember any of their names or their accomplishments as individuals. Other than the astronauts, I don't remember NASA being segregated in any way but this could be because in 1958 when the National Advisory Committee for Aeronautics changed to NASA, segregation was abolished. However, it wasn't until the space shuttle that I remember the crew for each mission being comprised of anything other than white guys. Nevertheless, I do remember some stories about Katherine Goble Johnson and how John Glenn specifically asked her to calculate his trajectory and reentry calculations. As with most films that deal with mathematics or science, this film is guilty of pushing the concept of immediacy as discussed by Appelbaum (1995) when Katherine verifies John Glenn's calculations in a matter of hours when in reality it took her several days.

The film is about three African-American women Katherine Goble Johnson (Taraji Henson), Mary Jackson (Janelle Monáe), and Dorothy Vaughan (Octavia Spencer), working at NASA's Langley Research Center in Hampton, Virginia, in 1961, and their impact on the U.S. space program. All three worked together in the segregated West area computers division where

Johnson is a computer, Jackson is an aspiring engineer, and Vaughan is the unofficial supervisor of all the women in the division pool. According to Heather Deiss (2016), in *Katherine Johnson: A Lifetime of STEM*, in the 1950s, "the National Advisory Committee for Aeronautics, the predecessor to NASA, was ...specifically looking for African-American females to work as "computers" in what was then their Guidance and Navigation Department." A computer was someone who did calculations. They were responsible for verifying or finding solutions to all of the technical or engineering calculations. Although the movie takes place in 1961, "Johnson began working for NACA in 1953" (Deiss, 2016).

The film follows the lives of these women and how they succeeded in the face of the racism and sexism of the time. We see elements of racism and sexism from the very beginning of the film when the women are confronted by a white police officer. We see the impact of segregation when Katherine has to walk across the campus just to use the colored bathroom. Although in reality Jackson was the one who had to run to the colored bathroom. Katherine has claimed that she just used the closest women's room. We see elements of sexism in the scene where Katherine meets Jim at a barbecue and he voices his skepticism at a woman's mathematical ability. Jim was just expressing the stereotypes that had become the norm. We witnessed how segregation was in direct conflict with the mission at hand. The movie gives us examples on how the entire idea about segregated bathrooms is very unproductive. Katherine faces sexism and racism when she is not allowed into meetings and when she does the work her name is removed from all the reports. Nevertheless, in 1960 she becomes the first woman to coauthor a research report and eventually would do the telemetry for the Apollo 11 and 13 missions.

While watching this film I kept wondering why they were looking for African-American

women to do these mathematical calculations considering the public view at the time. For example, women, African-Americans, and many other minorities, were considered intellectually inferior. If these views were actually true, why would they hire African-American women as computers? Evidently NASA did not view these women as intellectually inferior because people's lives would be impacted by these calculations. However I am somewhat sure they were paid less than their white counterparts. All three women in the film help reinforce the feelings of many black Americans when it comes to their accomplishments and how although they are better educated or more qualified there is still high probability that they will not get the job or promotion. The film shows how people of color were treated in the 1950s and 1960s no matter what type of work they did to advance the country and all humans. All of these women are considered hidden figures because their accomplishments and successes have been hidden to the masses. Nevertheless, the film helps to shatter the myth that African Americans and women can't do mathematics and helps reinforce the idea that no matter a person's gender or race they still have the ability to learn mathematics. I do believe that this film will help promote positive attitudes towards mathematics and give women and minorities the confidence that they too can become mathematicians, scientist, or engineers.

21

Lets consider the movie *21* released in 2008 by Columbia Pictures that supposedly tells the story of the MIT Blackjack team and how they won thousands of dollars playing Blackjack. The film was based on the best selling book *Bringing Down the House* (2002) by Ben Mezrich. Although the book was inspired by the true story of the team, there have been many embellishments in order to bring the story up to Hollywood standards. For example, everything is portrayed as much bigger than life and yet so simplistic. The movie has sex, violence,

suspense, drama, and conflict. The movie also incorporates the common theme of the boy meets girl, the girl plays hard to get, and the girl influences boy. Once again we see the female made to look like a temptress. A theme that is definitely not new because we have seen this portrayed as far back as the book of Genesis where Eve tempts Adam in the Garden of Eden.

Also, they made it look easier to win than it really is. One thing that you never notice in the movie is all of the hard work that it actually took before the team ever played for real. The movie made it look as though it would take only a small amount of time to learn how to become a successful card counter. It gives people, once again as most movies do, the feeling of instant gratification as well as a false sense of power. It gives the perception that a person with no math knowledge can beat the house and that anyone can count cards. However, there are many more variables involved than the ones shown on the screen. Nevertheless some of the people that watch the movie will think about going to Vegas, counting cards, and winning some cash. They state many times in the movie that counting cards is not illegal; however, they make it look like a crime to count cards. With a little knowledge of probability it is easy to see that a crime is being committed not by the player but the house. There are many people that believe that gambling at the casinos is fair, but statistically you are just giving away money. If a person was to consider the expected value of gambling games they would quickly see that in the long run it is a losing proposition. After watching the movie, people that are already addicted to gambling will feel that they now have the knowledge to break the bank.

As I viewed the film, I began to notice that it was packed full of the traditional anti-intellectual rhetoric. For example, there are a few scenes where Ben is portrayed as a freak of nature because he is good with numbers. This is the usual anti-intellectual stereotype of a person good in mathematics and it just reinforces the stereotype that people with good math skills must

be freaks of nature or abnormal in some way. Hofstadter (1962) reminds us that anti-intellectuals preach that “genius is often accompanied by some kind of personal disorder” (p. 423). If someone is genius, then something must be wrong with them. Also, it gives the impression that meritocracy is a myth and that people with no money have no hope. A guy as smart as Ben Campbell, who has worked hard and established a very impressive resume, can’t attend Harvard unless he can win a scholarship or come up with \$300,000. Here in the South that number is unthinkable in most households, much less just to attend college. This gives the impression that it will do a person no good to spend the time studying and acquiring knowledge because without money or privilege it is impractical.

One of the statements that you hear throughout the movie is that counting cards is simple math. However, they make it seem as though it takes a math genius to do simple math. It portrays girls, money and Vegas as more important than a science fair, and as talked about in the *Merchants of Cool*, *21* portrays the teacher as a manipulating, greedy, self centered, vindictive user that cares nothing about anyone but himself and gives the impression that teachers are villains that students should watch closely and never trust. Students must spend their time thinking about ingenious ways to out smart their professors. This whole premise is very far from the actual truth.

Anti-intellectualism articulated with the media and corporate order.

Anti-intellectualism articulated with mass media and the corporate order have created a commodity based anti-intellectual generation who believe that adults are the enemy and it’s cool to be dumb. For example, some time ago I was invited by some of my friends to watch a Frontline Special called *Merchants of Cool* starring Mark Crispin Miller, Douglas Rushkoff, and Robert McChesney. My friends know about my interest in the media and said that I would really

enjoy the program. This show gives a gripping account of how the media is responsible for creating a commodity based anti-intellectual generation and how kids are being singled out by advertisers because they can be easily persuaded. The show describes how the media uses the concept of being cool and the fact that kids are impressionable to keep them desiring and buying things that they don't need and in many circumstances can't afford. As Mark Crispin Miller states,

often there's a kind of official and systematic rebelliousness that's reflected in media products pitched at kids. It's part of the official rock video world view. It's part of the official advertising world view that your parents are creeps, teachers are nerds and idiots, authority figures are laughable, nobody can really understand kids except the corporate sponsor.

In addition, these corporations use a divide and conquer tactic by creating an outlet for kids to be rebellious against anyone considered as part of the establishment, which includes teachers, parents, and the government that have a serious impact on a person's motivation to learn.

Also the advertisers know that if the kids don't have the money to buy an item, they will just persuade their parents to buy it for them. The show goes on to talk about how executives spend loads of cash to research better ways of control and influence, and no matter how hard it is to influence teenagers, researchers will do it. According to Douglas Rushkoff,

nothing is going to stop this market researcher because the information he's looking for is worth an awful lot of money. At 32 million strong, this is the largest generation of teenagers ever, even larger than their Baby Boomer parents. Last year teens spent more than \$100 billion themselves and pushed their parents to spend another \$50 billion on top of that. They have more money and more say over how they'll spend it than ever before.

What is disturbing is that children “spend more time viewing television and commercial programs than they spend in school” (Dimitriadis & Carlson, 2003, p. 57).

The show talks about all of the different media companies responsible for selling influence and the list is very small. Today almost all movies, television, and music are controlled by a small number of entertainment companies. For example, Robert McChesney in *Merchants of Cool* states

The entertainment companies, which are a handful of massive conglomerates that own four of the five music companies that sell 90 percent of the music in the United States—those same companies also own all the film studios, all the major TV networks, all the TV stations pretty much in the 10 largest markets. They own all or part of every single commercial cable channel.

They use mass media to create stereotypes that help them sell, sell, sell. They never consider the damage that can be done to our society. As Mark Crispin Miller posits,

when you've got a few gigantic trans-national corporations, each one loaded down with debt, competing madly for as much shelf space and brain space as they can take, they're going to do whatever they think works the fastest and with the most people.

These companies will use any means necessary to control and influence the masses.

However, this ‘school is not cool’ mentality only functions as a tool for hegemonic reproduction.

For example, a young man the other day told me he had quit school and stuck it to the man just like a guy he had seen in a movie. However, he didn’t realize that the man had stuck it to him. The question is why does he feel this way? According to Giroux (2002), certain Hollywood blockbusters

project onto post-Watergate youth a long legacy of anti-intellectualism that has been a

defining principle of American culture ... idiocy, over-the-top raunchiness, and empty-headed, deliberate outrageous behavior become the principle characteristics of a youth culture that defines its relationship to each other through spectacle of brutality, humiliation, and a self-centered indifference. (p. 175)

These blockbusters often portray people who excel in mathematics negatively and definitely not cool. Many times they create and reinforce negative social and cultural norms concerning education and the learning of mathematics that function to control, oppress, and reproduce race, gender, and class relations. For instance, these blockbusters create an atmosphere where people have no desire to learn mathematics. The problem is their lack of mathematical knowledge and ability is used against them by restricting access to higher education or better employment thereby controlling and exploiting them economically.

The mass media should help educate and create an intellectual environment; however, articulated with capitalism and anti-intellectualism it only functions to oppress. Today, two of the most influential forms of media that have been used to push an anti-intellectual, adults are the enemy, being smart is not cool message are television and film. Television shows such as *The Simpsons* and *Married with Children* encourage kids to disrespect their parents and anyone else they consider a figure of authority. In *Generation X Goes to College* (1996), Sacks helps to give us some insight on how anti-intellectualism encourages and even pressures many of our youth “to display a contemptuous or derisive attitude towards all the grown-up garbage that makes up higher education (p. 149). Also, a recent Nielson poll showed that the average person watches 5 hours of television a day. What makes this more disturbing is that parentstv.org claims “television reaches children at a younger age and for more time than any other socializing institution except the family.” According to Diety and Strasburger in *Children, Adolescents, and*

Television (1991) the average 18 year old has watched 22,000 hours of TV but has spent a total of 12,000 in school. That is 12,000 hours of school, not instruction.

When it comes to television, we see an endless supply of anti-intellectualism. One of my favorites, *Family Matters* is one of the longest-running U.S. sitcoms with a predominantly African American cast. Although people from every demographic tune in, the show is watched by large numbers of African Americans. One of the main characters, Steve Urkel is portrayed as a clumsy, nerdy, goofy, pathetic loser, who can't do anything right. However, his friend Eddie is portrayed as an extremely dumb athlete who is very popular in social situations. The show influences people to act like Eddie instead of Steve and I feel that this helps to reinforce some of the attitudes about education that we see prevalent in the African American community as well as the masses in general. I have heard some of my African American students say that Steve was acting white. When I asked them how they came to such a conclusion, they stated because he was smart. This stereotype is still so prevalent today that many students will never try to be successful in any subject because it may be detrimental to their popularity or status in their particular subculture.

One of the most surprising anti-intellectualist statements that I have heard comes from the popular quiz show *Jeopardy* created by Merv Griffin. The reason why it is so surprising is that I thought *Jeopardy* was a show geared specifically for intellectuals. *Jeopardy* is considered one of the most popular game shows in the history of television and therefore is very influential in American Culture. In our schools, many teachers use the *Jeopardy* format in their classrooms as a way to get students interested in learning information consistent with their subject area. In fact, I have used the down loaded version of the board in many of my classes as a way to get students to participate. *Jeopardy* is supposed to be a game show that celebrates knowledge and

intellectualism; however, it too can be responsible for advancing the cause of anti-intellectualism in America. For example, in an episode of *Jeopardy* that aired on October 3, 2007 on an NBC affiliated channel, Alex Trebek made a very anti-intellectual comment about one of the categories. As he read the categories, one was called Fun with Probability. He states “Fun with probability if there could be such a thing”. Now this may seem like a simple pun to many but to some it may help reinforce their negative attitudes about mathematics.

Another American cultural icon is the television news magazine *60 Minutes*, which is a part of CBS news and is one of the most successful broadcasts in television history. They have won more Emmy awards than any other primetime broadcast. They investigate allegations of corruption and injustices and portray themselves as helping Americans weed out all of the wrongdoers of the world. However, in doing so, could they be the ones responsible for injustice? In some cases, I think they are. We must recall that anti-intellectualists also portray themselves as the saviors or heroes of the common people, while in fact, they are actually working to help keep the masses oppressed and in their proper social class. They convince us that they have our best interests in mind while pushing their agenda. In a *60 minutes* episode that aired on December 30, 2007 about the Geek Squad, Steve Kroft made the comment “the thought of learning something new makes my head hurt”. This statement is consistent with most anti-intellectual rhetoric. However, was his comment an attempt at humor or was it a reflection of how the majority of Americans feel about learning? This kind of statement can have an enormous impact on how our culture views education and learning in general.

Some of the heroes in American movies have also been very influential in the advancement of anti-intellectualism. Hofstadter (1962) claims “American heroes were notable as simple, sincere men of high character” (p. 307). These stereotypes are evident in movies such as

Sergeant York and *Forrest Gump*. For example, in *Sergeant York*, Gary Cooper played a simple semi-illiterate hillbilly who fought courageously even though he was against war and killing while Tom Hanks in *Forrest Gump* played a somewhat slow-minded, gullible fellow with a heart of gold who eventually becomes a hero and a celebrity. In most early westerns, an intellectual is rarely seen and when they are it is usually getting saved by the uneducated cowboy. In *The Shakiest Gun in the West*, Don Knotts plays an eastern dentist who goes westward. However, he is an educated and civilized man who finds himself in an uncivilized west. Because he lacked the tough, strong, macho facade and animal instinct that people of the west were considered to have, he is constantly being picked on, humiliated, and embarrassed. After he is humiliated time and again, he finally saves the day in the end with the help of a woman. There have been many movies and television shows that portray mathematicians as goofy, insane, or dangerous. Most, if not all of these stereotypes are consequences of the American anti-intellectual movement. For example, the movies *A Beautiful Mind* and *Proof*, just to name a few, gives the impression that mathematics is depressing and that mathematicians are crazy or insane. However, depression is a word that comes to mind if we take away all of the advancements and luxuries that mathematics and science has given us for which we take for granted.

Media that produce positive attitudes concerning mathematics

Although we have witnessed the negative influence of the mass media and the picture that I have painted is bleak, scholars such as Walter Benjamin, C.L.R. James, Antonio Gramsci, Rudolf Arnheim, Raymond Williams, Stuart Hall and numerous others believe that the mass media has great potential and is capable of transforming our culture in positive ways. For example, Williams has warned us that television as a medium can be a strong force both for good and bad, and according to Arnheim television is “a gift of the last century ...[because it] changes

our attitude to reality: it makes us know the world better and in particular gives us a feeling for the multiplicity of what happens simultaneously in different places” (1957, p. 194). It shrinks our world. “Gramsci believed that ‘mass media’ and ‘education’ are the only two institutions in modern society capable of favorably transforming the cultures and politics within which they operate” (Clausson, 2003, p. 64). “Most critical media attention has focused on the virtual as having only negative dimensions, but new points of inquiry have found that the ‘virtual’ can be used for affective purpose because it seduces populations” (Webber & Reynolds, 2004, p. 206).

I agree with all of these scholars, and believe that the mass media has the power to create a positive social and cultural image of mathematics that can help motivate people to learn. The mass media has the power to change the perception of mathematics and science and can do a great deal to advance any subject. For instance, years ago the majority of the American people never knew what an archaeologist was and definitely never considered studying the field of archaeology; however, after the release of *Raiders of the Lost Ark*, there was a huge interest in the subject. Because Indiana Jones was portrayed as a cool, hard, and rough individual definitely not an effeminate nerd or geek, he made the study and field of archaeology glamorous. The television show CSI created such positive attitudes about forensic science that many educational institutions had to start new programs or expand their existing programs in forensic science to accommodate large numbers of students wanting to study in this field. Television shows and films such as *Numbers*, *The Big Bang Theory*, and *21*, all help create a positive image of mathematics and science however, some still possess anti-intellectual undertones.

In Penley's *NASA/TREK* (1997), she discusses how NASA and star trek have shaped our popular culture. NASA changed the way we view space exploration and Star Trek helped to humanize our relations to science and technology. During the space race of the sixties, there was

an increase in the number of students applying for college to study science and mathematics. However, was the space race responsible for the increase in the numbers of students studying mathematics and science, or was it because of the media influence? Since we were in a space race, the dominant culture could have used all of its media power to help influence the choices of study for students planning on a college degree. Even though I don't consider myself a full blown trekkie, I do feel that Star Trek had a good message. For example, "for better or for worse, an astonishingly complex popular discourse about civic, social, moral, and political issues is filtered through the idiom and ideas of Star Trek (Penley, 1997, p.17). For example, Star Trek helped us to reflect on race relations by showing not only people of one world working together and respecting one another, but many different species from many worlds. Not only did Star Trek address some serious social issues, it also helped pave the way for technological rewards. For example, the cultural production of cell phones and their use today came from the influence of Star Trek. However, as we can see the cell phones are also a major commodity bought and sold which helps to promote the capitalist machine.

Conclusion.

After considering many of the theories, concepts, and views of cultural and media studies, and reflecting on my experiences with the mass media, I would conclude that it is possible for the mass media to shape, manipulate, and control our thoughts and actions. We have seen the power that mass media can give a dictator and how it can be used to socially control an entire country. Because of their ability to reach large numbers of people at the same time, the mass media has the power to create a unified outlook which functions to reproduce and reinforce our common values, morals, beliefs, identities, desires, likes, dislikes, attitudes, perceptions, and stereotypes, as well as legitimize existing power struggles. This "cultural production," carried

out by the mass media, according to Denzin and Lincoln (2003) “can often be thought of as a form of education, as it generates knowledge, shapes values, and constructs identity” (p. 442).

Today we have television, internet, and mobile devices which give the mass media the ability to reach millions, if not billions, of people at the same time. We are now living in “Hyperreality ... an information society socially saturated with ever – increasing forms of representation: film, photographic, electronic, and so on. These have had profound effects on the construction of the cultural narratives that shape our identities” (Denzin and Lincoln, 2003, p. 454). “These new technologies cannot be seen apart from the social and institutional contexts in which they are used and the roles they play in the family, the community, and the workplace” (Denzin and Lincoln, 2003, p. 455). Furthermore, they have created

representation wars ... between and across societies, in part because new communications technologies are enabling more people to receive and compare different local, regional, national, and global representations of their own and others’ lives- and sometimes take issue with what they see. (Denzin and Lincoln, 2000, p. 323)

The ability to reach millions, if not billions, of people at the same time creates an environment where the mass media can not only influence us culturally, socially, and personally, but can also influence us globally. It can shape how we view the world and ourselves. The only question that remains is to what extent is their level of control.

We have seen the impact of the mass media and the anti-intellectual movement in creating many of the stereotypes that depict people who are good in math as abnormal or freakish and this has significantly contributed to people’s desire to be incompetent when it comes to mathematics. For instance, the media portrays people who are good in math as mentally ill. Why else would someone want to do math? If a person is good in math they must be insane. Since

most people base their perceptions of reality on these media representations, is it any wonder why our society has such a negative perception of mathematics? I have seen these stereotypes cause boys and girls to pretend to be bad in math and science in order to keep their popularity status. They never realize how the mass media uses misinformation, pseudoscience, and propaganda to manipulate and convince the masses of their argument or to convince people to do things they might not ordinarily do. This could help explain why “academic knowledge languishes in an anti-intellectual and commercial culture concerned only with practical applications” (Pinar, 2007, p. 21).

The mass media articulated with advertising has been used to advance the capitalist ideology by influencing people to buy into the capitalist system literally by getting them to spend money they don't have on things they don't need. However this is somewhat easily done because Stuart Hall states that “modern culture is relentlessly material in its practices and modes of production” (1997, p. 223). According to Vinson & Ross (2003),

merely by virtue of our existence as consumers within a capitalist, profit driven system, a system that exploit technological change for its own “efficient” benefits, we face, as we continuously negotiate our quotidian and image-mediated existences, the constant bombardment of ourselves (our bodies, our senses, our minds, our souls) by myriad visible/optical representations (e.g., advertisements, “action figures,” e-mail, PSAs, video-clips, “breaking” news, and so on). Fundamentally, visual culture and everyday life meet and are mutually (re)productive, (re)inforcing, and (re)empowering. (p.25)

Hollywood takes full advantage of this because they “routinely twist and shape reality to maximize dramatic or comic effect for commercial purposes” (Bulman, 2005, p. 1). “A multimedia world is perceptual, not linear, in the utilization of concepts, but pattern concepts are

received upon impact as perceptual experience” (Pinar et al., p. 217).

People should be aware of how the mass media can be used to manipulate and normalize social and cultural norms in order to promote some social or ideological agenda. However, the mass media understands that “one of the ways in which you can keep the bewildered herd from paying attention to what’s really going on around them, keep them diverted and controlled” (Chomsky, 2002, p. 44). Nevertheless, people need to become aware of the media control so that the hegemony of the dominant culture can be diminished. They need to be given information in order to make intelligent choices. Therefore, educators need to make the public aware of the media and teach them methods necessary to become an intelligent consumer. Our only hope is to educate everyone in media studies. Teachers today are not the only educators of our children; however, educators should not look on the media as bad or evil. Through critical evaluation, educators can find many constructive uses for media. Unless people realize they are being manipulated and change course, we will remain in conflict unable to break free from our oppression. “There is no excuse for letting another generation be as vastly ignorant, or as devoid of understanding and sympathy, as we are ourselves” (Snow, 1998, p. 61).

We must heed the advice of Arnhiem when he states “television is a new, hard test of our wisdom. If we succeed in mastering the new medium it will enrich us. But it can also put our mind to sleep” (1957, p. 195). “Mass media represents the greatest force for social control ever imagined and media education represents an acritical and celebratory indoctrination into the mechanism and techniques of this control” (Sholle & Denski, 1994, p. 8). Nevertheless, there are still many people who believe that the mass media have no influence or impact on them other than entertainment. They never realize the enormous impact the media has on their lives and therefore are media illiterate. For students to become media literate they need an understanding

of how all aspects of the media function such as production, analysis, and evaluation. For example,

critical media literacy involves assisting students to understand-to read (1) what role the media play in terms of creating individual and group subjectivities and (2) how to counteract the manipulative and depowering tendencies of the media as they work to control, dictate, monopolize, determine, and perpetuate hierarchies of social, cultural, economic, political ideological, and pedagogical power. (Vinson & Ross, 2003, p. 142)

It is my hope that after this discussion it will become hard to deny the mass media's role in constructing and reproducing many of our current views about education and mathematics and the social problems that have resulted from these views.

Hence, it is of vital importance that we as educators teach students to be aware of the uses of mass media. "A critical pedagogy of media would serve to reintegrate our lives, focusing on the political and cultural implications of both watching and producing" (Sholle & Denski, 1994, p. 9). In teaching students about production, educators could have students create their own media. For example, students could produce radio shows, television programs, websites, or movies. By doing this students could learn about how the various types of media are constructed, and how a simple cut and paste in editing can change the entire intended meaning. Students should learn how to critically evaluate media. For example, the students should be able to evaluate media subjectively and for its aesthetic value. Most importantly however, students should learn about the many techniques that the media uses to influence. They should understand how the media can inform, entertain, and persuade. In teaching students about mass media we must have them ask the questions: in whose interest does the mass media serves and to what extent?

On the bright side, once students understand how the media works they will become more involved in critically thinking about programs. Their eyes will be opened to a new world where they are able to watch programs that they have seen many times and notice many things that used to be invisible. For example, when I first learned to sing harmony, all of the music that I had listened to in the past seemed to change. The music itself was the same; however, my ears had been open to a whole new world. I began to hear instrument parts and vocal parts that I had never heard before. It was a very enlightening experience. Therefore, I believe that media education would do the same thing by helping people be able to better evaluate the validity or truth of the information given by the media. Once students become aware of the many methods of propaganda, control, and reproduction used by the mass media, they will have the means to resist. The kids of the new generation will be inundated with images to the point where they start to experience information overload. The video games get more and more realistic which blurs the line between fantasy and reality even more than it is today. However, it is up to the educators to fight back and try and build a world of democracy, compassion, and justice.

CHAPTER 6

CHAOS IN MATHEMATICS AND CURRICULUM STUDIES

Throughout this investigation, I have been examining why we view math the way we do in the United States, and how these views, many of which are negative, have created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate when a lack of this knowledge can function to control, oppress, and exploit. Therefore, in this chapter, I hope to gain a deeper understanding of why we consider anything that functions to control, oppress, and exploit socially and culturally acceptable, especially mathematics by exploring some of my issues through the theoretical framework of postmodernism. For example, postmodernism considers all knowledge, concepts, or ideas as well as our views and attitudes about mathematics as historically, culturally, and socially constructed and made legitimate by the use of what Jean-Francois Lyotard, in *The Postmodern Condition: A Report on Knowledge* (1984) calls grand narratives or meta-narratives.

Some of these narratives are historically constructed for the purpose of explaining why some people have power and some don't or why some people are wealthy and some are poor and according to Lyotard (1984) are crucial to the process of "legitimation" (p. xxiii). Therefore as a mathematician, I am very concerned about the fact that mathematics has become another one of Lyotard's grand narratives used for the purpose of legitimizing power relations. We've seen throughout this exploration that there are also grand-narratives about mathematics that create social and cultural viewpoints that function to legitimize power relations and explain why some people are good at math and some people are bad or why some people love mathematics while others hate it. Many of these narratives, stories, and representations convince people that mathematical ability is determined by race, gender, or social class and that not everyone may

possess mathematical ability, or that learning mathematics is not cool and definitely not necessary. Therefore, these narratives have become major components in the mathematical hegemony perpetuated on the masses used to manipulate, reproduce, and control.

The negative views created by these narratives have created an environment where people have no desire or motivation to learn mathematics because they view mathematical knowledge and ability as something they just don't need and because they view mathematics as having no value. The problem with this premise is a lack of this knowledge and ability can be very detrimental to a person's success. Although these negative views function to normalize and make legitimate our social and cultural acceptance of mathematical illiteracy and innumeracy, there are many people who resist this mathematical hegemony, and the influence of these narratives, and place a very high value on mathematical knowledge and ability. Postmodernism's concept of multiple interpretations of reality gives us insight into why this mathematical hegemony works on some, but not all, and how various texts or statements influence some but not others. For instance, postmodernists believe that each person interprets reality differently and responds differently to the influence of various narratives. Nevertheless, these narratives have great power in constructing our social and cultural views of mathematics and mathematics education.

However, in this chapter, I will explore the grand narrative of mathematics as a discipline, and the role it plays on our mathematical pedagogy and curriculum that have a serious impact on the teaching and learning of mathematics. I will explore teaching mathematics at a time when the very foundations of mathematics are in question by considering many of the concepts, notions, and ideas associated with postmodernism, complexity theory, chaos theory, non-linear dynamics, and fuzzy systems. Is it possible that some of these concepts, notions, and

ideas could help us formulate new theories about mathematical curriculum and pedagogy that function to create positive social and cultural views of mathematics and increase a person's motivation and desire to learn? What is our current image of mathematics and what impact does this image have on our motivation and desire to learn? Is it possible to change this image to one that is more positive? Finally, by considering fuzzy systems and using the analogy of fusing heterogeneous fuzzy data for clustering, I will discuss ideas on how we can change our current mathematical curriculum and pedagogy in order to create more autonomy and motivate students to learn.

Teaching math at a time when the very foundations of mathematics are in question.

Postmodernism has changed the way we look at many things, especially mathematics. For instance, when traditional mathematics failed to answer many of our questions, some speculated that our present philosophy of mathematics may have taken us down an incorrect path. A mathematical path that may limit how far we can go technologically. For example, there are endless numbers of cases where deterministic models fail in finding accurate solutions. Models that involve random behavior such as air turbulence or the weather sometimes fail terribly in making deterministic predictions. Therefore, there comes a time when we have to reflect and reevaluate our mathematical methods and viewpoints. Cherryholmes in *Power and Criticism* calls this critical pragmatism the "results [of] when a sense of crisis is brought to our choices, when it is accepted that our standards of beliefs, values, guiding texts, and discourses-practices themselves require evaluation and reappraisal" (1988, 151). Over the years, there have been many changes in terms of our mathematical philosophy. Paul Ernest in *New Philosophy of Mathematics* (2009), discusses in great detail the differences between the traditional (also called absolutists) and the new or postmodern (also called fallibilist) philosophies of mathematics.

Traditional or Positivist Philosophy

For instance, we have moved from a positivist philosophy that considers ideas or concepts in terms of universals or absolutes to a post-positivist philosophical orientation that considers things true until proven otherwise. The traditional philosophy of mathematics considers mathematical knowledge as "certain truth; objective, super-human, asocial, acultural, apolitical and absolute" (Ernest, 2009, p. 46), and

is dominated by Platonist orthodoxy according to which mathematical objects are metaphysically real, 'out there,' independently of and somehow prior to human cognition and discourse: by studying these objects that are given and exists before us, we discover or discern – but in no way shape, let alone create – what is 'true' about them. (Rotman, 1993, p. 43)

According to Whitehead (1958), "the leading characteristic of mathematics [is] that it deals with properties and ideas which are applicable to things just because they are things, and apart from any particular feelings, or emotions, or sensations, in any way connected with them" (p. 2).

Although mathematics has evolved and moved away from the positivist view, the power of these views can still be felt in a mathematics classroom. For example, many students have been led to believe that there is only one unique absolute universal way to solve a problem and never consider the many other ways to find a solution.

Post-positivist philosophy of mathematics

Throughout history we have seen phenomena considered absolute or universal later be proven otherwise and these events have led us to a post-positivist philosophy of mathematics. Post-positivists are similar to positivists in their beliefs that natural phenomena are universal and absolute. However, unlike that of the positivist philosophy where formulae or theories are

considered absolute or universal, the post-positivist philosophy considers the formulae or theories used to predict a phenomena true until proven otherwise. For example, Quentin Meillassoux in *After Finitude* (2009), posits "since Popper ... every theory advanced by empirical science is by right revisable: it can be falsified and supplanted by one that is more elegant, or that exhibits greater empirical accuracy" (p. 12). "The vital point in the application of mathematical formulae is to have clear ideas and a correct estimate of their relevance to the phenomena under observation" (Whitehead, 1958, p. 18). However, this is not always the case because sometimes the formula or theory may not work as intended or expected and that is why a post-positivist philosophy of mathematics considers all knowledge refutable and revisable, nothing is ever set in stone. Fleener (2005), is very critical of positivist and modernist notions and considers them the "consequences of an emphasis on the scientific method as the paragon of rationality" (p.7).

However according to Ian Stewart in *From here to infinity: A guide to today's mathematics* (1996), with the vast history and knowledge of mathematics that makes up our traditional philosophy of mathematics, "basic questions are still unanswered" (p. 13). That is why according to Davis in *Teaching Mathematics* (1996), today we are "moving out of this modernist science with its narratives of linear equations into a postmodernist science of which Chaos Dynamics is one important visual expression" (p. 279). The postmodern influence on mathematics has helped us to consider that nothing is static, universal, or absolute because the world around us is complex, dynamic, and ever-changing, and is helping us to understand that other paths are possible and that there may be unattainable knowledge. For instance, Plotnitsky in *The knowable and the unknowable: modern science, nonclassical thought, and the "two cultures"* (2002), discusses in great detail the impossibility of attaining certain knowledge present in nature that according to Meillassoux, forces us "to reconsider our belief in the

permanence of physical theories because of the impossibility of attaining certain knowledge of the 'active factors' that may be present in nature" (2009, p. 85). Postmodernism encourages us to move beyond the traditional philosophies of mathematics and its associated limitations toward a new philosophy of mathematics open to all possibilities.

New postmodern philosophies of mathematics

These new or postmodern philosophies of mathematics, also called "Nonclassical" (Plotnitsky, 2002, p.13) or "Postclassical" (Smith & Plotnitsky,1997, p. 2), considers mathematical knowledge "socially, culturally constructed and politically situated; Corrigible and eternally revisable knowledge" (Ernest, 2009, p. 46). Postmodernists consider there to be no final or absolute meaning for any particular sign or text and hence, no interpretation or discourse is better than any other. They argue that there is no one way of knowing and no one accurate form of knowledge. This is why today, according to Denzin and Lincoln (2000),

the use of quantitative, positivist methods and assumptions have been rejected by a new generation of qualitative researchers who are attached to poststructural and/or postmodern sensibilities. These researchers argue that positivist methods are but one way of telling stories about society or the social world. These methods may be no better or no worse than any other methods; they just tell different stories. (p. 9)

Therefore, mathematical knowledge and concepts may only give us a partial story when trying to explain phenomena and may need to be evaluated and revised.

Postmodernism considers all knowledge is historically, socially, and culturally constructed and therefore take a constructivist view that "mathematical objects are constructed by individuals in both physical and social interactions"(Moses, West, & Davis, 2009, p. 248). These new postmodern views of mathematics may help to elevate mathematics because "a new

viewpoint can have a profound psychological effect, opening up the entirely new lines of attack" (Stewart, 1996, p. 9). These new lines of attack have resulted in new types of mathematics that were never considered using the traditional philosophy. For example, according to Davis,

three branches of inquiry, in particular, are worthy of note: fuzzy logic, non-linear dynamics, and complexity theory... It is thus that the imagery offered by non-linear dynamics – or chaos theory – is displacing that of the linear equation to serve as a visual metaphor for our understanding of phenomena and relationships. (1996, p.14)

Chaos and complexity theory, fuzzy logic, non-linear dynamics as well as fractal geometry have given us new ways of thinking about mathematics and helped to liberate “modern Western cultures from the grip of certainty that [our traditional] logic has provided for centuries" (Trueit, 2005, p.78).

Chaos and Complexity

“Chaos theory, a new frontier of mathematics, offers models and computer-generated images that reveal order and underlying patterns where only the erratic and the unpredictable had been observed” (Blitzer, 2010, p. 663). In *What is Chaos Theory?* (2014), Jonathan Wolfe of the Fractal Foundation states “chaos is the science of surprises, of the nonlinear and the unpredictable. It teaches us to expect the unexpected.” It is during these unexpected results that we learn to expect the unexpected. Chaos "is a phenomenon that affects the whole of nonlinear dynamics, and hence almost all areas of applied science" (Stewart, 1996, p. 227). Chaos is what you get when you try to use linear deterministic models to make accurate predictions of, or describe the behavior of non-linear, complex, and dynamic phenomena. Although in some cases these methods may provide fairly accurate results, there are some cases where "the behavior of the system becomes, in general, chaotic, which prevents deterministic predictions" (Plotnitsky,

2002, p. 47). "Chaos Theory deals with nonlinear things that are effectively impossible to predict or control, like turbulence, weather, the stock market, our brain states, and so on" (Wolfe, 2014). In addition, this new type of mathematics can help us in "yielding descriptions of everything from earthquakes and dripping taps to heartbeat rhythms, the distribution of interstellar gas clouds, word frequency in natural languages, and so on" (Rotman, 2000, p. 74).

Chaos theory is the study of the behavior of dynamical systems that came about "in the late 1950s, [when Professor Edward Lorenz, a MIT meteorologist considered by many the father of chaos theory] discovered quite by accident a particular quality that is now referred to as 'sensitivity to initial conditions'" (Stanley, 2005, p.136). Lorenz "instigated and developed techniques for studying dynamical studies such as the weather" (Fleener, 2005, p.9). According to Smitherman, although "this idea originally emerged out of the work of Edward Lorenz (1963) ... [it] was not termed 'chaos' until the publication of Tien-Yien Li and James Yorke's (1975) 'Period Three Implies Chaos' paper" (2005, p.154). The concept of sensitivity to initial conditions has helped us understand that sometimes it is very difficult to determine the outcome of a complex system. We may never accurately describe enough initial conditions to predict the outcome. For example, according to Wolfe (2014),

we can never know all the initial conditions of a complex system in sufficient (i.e. perfect) detail, we cannot hope to predict the ultimate fate of a complex system. Even slight errors in measuring the state of a system will be amplified dramatically, rendering any prediction useless.

Nevertheless, the evolution of the computer and the field of theoretical computer science and mathematics has given us a new area of research called computational complexity theory which provides us with many new, different, and exciting ways in which to consider mathematics.

My first association with chaos theory came about while trying to solve questions associated with aerodynamics. For example, chaos theory is used to explain the influence of air turbulence on wings and the fuselage and why under rare unpredictable circumstances this turbulence causes catastrophic results. In many cases we are able to determine the influence of this turbulence on the structures, however in some we cannot. According to Stewart (1996) this is because "turbulence is both regular and irregular" (p. 226). Nevertheless, we need to understand chaos in order to reduce and avoid its many catastrophic effects that may end up costing loss of property and loss of life. For example, Stewart warns us that "even if your only interest in chaos is to get rid of it, you'd better understand how it comes about. *Know your enemy*" (1996, p. 227). Furthermore, "chaos is useful. It helps us to understand complicated phenomena such as epidemics, or irregularities of the heartbeat. More than that: you can exploit chaos to attain a desired end" (Stewart, 1996, p. 227). Chaos theory's

message is that *some* things that we think we understand may behave in very funny ways, *some* things that appear random may obey laws we haven't yet spotted, and *most* things don't fit into any of these categories at all. Indeed Chaos theory has opened up new methods for *controlling* systems that appear to behave randomly. (Stewart, 1996, p. 235)

"Chaos is not simply disorder. Chaos explores the transitions between order and disorder, which often occur in surprising ways" (Wolfe, 2014).

Out of chaos and complexity theory came the notion of fractal geometry, another new nonlinear form of mathematics. "The word fractal was coined by Benoit Mandelbrot to convey the irregularity and fractured quality of this new mathematical concept in its vivid capture of nature's flow" (Wang, 2005, p.303). In Mandelbrot's book titled *The Fractal Geometry of Nature*, he discusses in great detail his Mandelbrot set. According to Stewart, this "particular fractal has

attracted enormous public attention ...[and has become] a test-bed for the theoretical investigation of fractal structures that come up in an area known as *complex dynamics*" (1996, p. 246). According to Wolfe (2014),

fractal mathematics, ...captures the infinite complexity of nature[,] ...[and] many of the systems in which we live exhibit complex, chaotic behavior. ...A fractal is a never-ending ...infinitely complex ...[pattern that is] self-similar across different scales. They are created by repeating a simple process over and over in an ongoing feedback loop. Driven by recursion, fractals are images of dynamic systems – the pictures of Chaos. Geometrically, they exist in between our familiar dimensions. Fractal patterns are extremely familiar, since nature is full of fractals. For instance: trees, rivers, coastlines, mountains, clouds, seashells, hurricanes, etc.

According to Rotman, "fractal geometry ...chaos theory and the modern investigation of dynamical systems in terms of discrete time states [would be] impossible to develop without the computer simulations of such states" (1993, p. 150). Nevertheless, "what is gained in moving to a complex analytic is a new and powerful way of understanding the patterns that appear in the world – and in ourselves" (St. Julien, 2005, p.109)

Fuzzy systems

For a long-time mathematics has been caught up in the rigid formalism of Cartesian thought; however, postmodernism has changed our western views of mathematics in terms of hard or crisp logic. For example, "Western systems of logic are founded on a belief in the possibilities of clean definitions, crisp edges, and unambiguous categories" (Davis, 1996, p.157). However, postmodernism has convinced us to look at mathematics differently and this had a profound effect on the creation of new types of mathematics. For example, in the 1960s Dr. Lotfi

Zadeh of the University of California at Berkeley formulated ideas that would lead us to a new area of mathematics called fuzzy logic. Before fuzzy logic, we were caught up in the Aristotle, Boolean, or binary logic that convinced us to use "the same 1– 0, all-or-nothing mentality ... evident in much of our formal interaction" (Davis, 1996, p.157) with mathematics.

Using traditional binary logic, variables were either true or false, but not both. For instance, let's consider our variable of interest to be 5. If we consider all the elements in a set and formulate a method to encode and decode each element, an element of 5 would be encoded and represented by the number one. If the element in the set is not a 5, it is encoded and represented by the number zero. However, fuzzy logic variables range in value from 0 to 1 just like binary logic except fuzzy variables can take any real number values between 0 and 1. Instead of looking at variables in black and white, the boundaries were gray or blurred making them fuzzy. For example, merriam-webster.com defines fuzzy logic as "a system of logic in which statements do not have to be entirely true or false." WhatIs.com defines fuzzy logic as "an approach to computing based on 'degrees of truth' rather than the usual 'true or false' (1 or 0) Boolean logic on which the modern computer is based." Therefore fuzzy logic allows us to use approximation in our reasoning in place of exact or fixed reasoning, and that is why it is used extensively in engineering, mathematics, and science.

What is our current image of mathematics?

As discussed in great detail throughout this exploration, our social and cultural views of mathematics and the learning of mathematics are very negative. Some of these views have been constructed by anti-intellectual narratives meant to mislead and control, and some have been constructed from previous experiences with mathematics and the learning of mathematics. Our overall image of mathematics, however, is probably constructed by a combination of these

different influences. For instance, there are various anti-intellectual narratives used to convince people that math is hard, it is very rigorous and usually takes a long time to master, not everyone can do it, and for the average person it doesn't matter anyway. These views in combination with bad experiences in a mathematics classroom construct and shape our image of mathematics. For instance, our "traditional popular image of mathematics is one of difficulty and remoteness from the concerns, interests, and capabilities of the majority of [the] population"(Ernest, 2009, p. 47).

Our previous experiences with mathematics especially in terms of mathematics curriculum and pedagogy also has a very profound impact on our motivation and desire to learn. For example, these experiences have created an image of mathematics curriculum as a preselected set of topics that the students have no say in selecting and that have no relevance in everyday life. These preselected topics amount to what David Jardine in *Curriculum in Abundance* calls "Regimes of scarcity" because with the richness and sheer number of topics available in the field of mathematics it seems ridiculous that we as educators should limit these topics to only a few. Our traditional mathematics pedagogy of lecture, recitation, and rote memorization construct and reinforce an image of mathematics as the "memorization and rote application of largely meaningless procedures" (Davis, 1996, p. 144). This is because according to Walkerdine (1998),

when people wish to complete some practical task successfully they may do so simply by following rules, by applying a procedure, but still have little idea of why the rules are effective, or of their range of application. On the other hand, people who apply a procedure and at the same time know its rationale may have a deeper understanding of the meaning of what they are doing and why the procedure works. (p. 31)

Our previous experiences with mathematics curriculum and pedagogy creates and constructs an

image of mathematics as material to be learned through recitation, drill and practice, and rote memorization of signs, symbols, and rules of which no one understands and have little or no relevance in the lives of students.

Many scholars place the blame on our traditional or conventional mathematics instruction and when we consider that the transmission and product models are the two most prevalent models used in education today, this is easy to understand. Appelbaum posits "traditional math instruction, emphasizes memorization, drill and practice ... [and] problems typically focus on numerical solutions rather than understanding what the numbers mean" (1995, p. 193). What is disturbing is that Dewey warned us of this issue in 1931. For instance, in *The way out of educational confusion*, Dewey is critical of how "subjects are labelled and memorized but students never understand what they have learned" (p. 24). Just because the information has been drilled into their brains, does not mean they have any type of conceptual understanding or the critical thinking skills needed to solve real life problems. Since they don't understand what the solution means, they have no desire or motivation in performing the work necessary to obtain it.

From my experiences as a math educator, I have witnessed firsthand how traditional math instruction not only functions to create a lack of interest in mathematics but also a serious lack of conceptual understanding of even the most basic of mathematical concepts which results in most students never acquiring the mathematical knowledge or critical thinking skills necessary to read and write the world with mathematics. Therefore, when we consider our traditional mathematics pedagogy of lecture, recitation, and rote memorization articulated with our historically, socially, and culturally constructed images of mathematics, it is easy to see why math is viewed as the rote memorization of signs, symbols, and rules learned by continuous drill and practice with only one right method or solution that most students fail to understand conceptually.

However, on the bright side, Ernest (2009) posits "the traditional school image of mathematics as something fixed with only one right answer, right method, or preferred model cannot be sustained when the tentative, socially constructed nature of mathematics is acknowledged" (p. 53). According to Sherrie Reynolds, when using rote memorization we have to be aware that

the unintended consequences of teaching [using this method] can be more powerful than the concepts we think we are teaching. ...[For example, when teaching] scientific concepts by asking students to memorize them, they may construct the idea that science is about facts that somehow just 'are,' even though one of the ideas ...[that they] memorize is the scientific method. (2005, p. 270)

Although mathematics as a discipline bears some responsibility in the construction of these negative images, many of these images do not accurately describe the subject. This is because "the technical trappings of the subject, its symbolism and formality, its baffling terminology, its apparent delight in lengthy calculations: these tend to obscure its real nature" (Stewart, 1996, p. 1).

What does this image have to do with our motivation and desire to learn?

One of the major points that I want to make throughout this discussion is that our historically, culturally, and socially constructed views of mathematics play a prominent role in our motivation and desire to learn. Therefore, our current image of mathematics has a serious impact on our desire and motivation to learn the subject because most of the time these socially and culturally constructed views are very negative and create an environment where no one has the motivation or desire to learn mathematics. According to Ernest,

although a small minority of successful students and practitioners of mathematics are

attracted by elements of this image, for a much larger group this is a negative view of mathematics that has arisen through negative aspects of their encounter with mathematics and its image, and which has turned them off mathematics. Consequently, for many the traditional image is associated with negative attitudes to mathematics. (Ernest, 2009, p. 47)

These negative attitudes have created an environment where people have no motivation or desire to learn mathematics and this has a serious impact on the teaching and learning of mathematics. In addition, Stewart suggests, the abstract nature of mathematics is why "many people admittedly find [it] repelling" (1996, p. 282).

Many people buy into all the myths and propaganda disseminated throughout our society and culture concerning mathematics because stories or myths, true or false, construct particular points of view and are very powerful in constructing and shaping our social and cultural norms. The image of "mathematics as some esoteric skill like perfect pitch that some people have and others do not" (Appelbaum, 1995, p. 139), convince people to throw in the towel and give up because they probably will never be able to learn mathematics anyway. People who feel this way definitely have no desire or motivation to learn mathematics. Furthermore, there are a multitude of other narratives that also help to reinforce this image. The images of people who are good in mathematics as flawed or insane and definitely not cool as well as the image that minorities can't do math or math is a male domain has a serious impact on our motivation and desire to learn. Many of these narratives, stories, and representations convince people that they don't need to learn and create an atmosphere where people have no desire to learn anything, especially mathematics. These images and views come into play when students rationalize and justify the reasons why they don't need to learn math. The many myths and stories legitimize many of our

negative attitudes and perceptions concerning math and because of this most people would go to extreme measures to avoid anything considered mathematical.

Under our current system, mathematics is no longer relevant to lives of most students. However, in *Child and the Curriculum*, Dewey argues that in order to increase a person's interest, desire, and motivation to learn we must link the teaching of subjects or topics to past experiences. However, since many people never learn the basics of mathematics, they haven't established any past experiences or knowledge to pull from. The image of mathematics as something that requires a great amount of time to learn and master, is why it is avoided like the plague. For example, according to Appelbaum, views of mathematics "as a 'hard' pure subject with intangible rewards for hard work was one reason cited" for why people don't have a desire to study math (1995, p. 170). Many blame a lack of desire on our traditional curriculum and pedagogy where students are passive and quickly lose interest resulting in them either sleeping or texting and not actively participating in learning. For example, one of the unintended consequences of using traditional methods is that learning becomes tedious and starts to be viewed as work. According to Walkerdine (1998), when using traditional methods,

Work, ...forms a metaphoric relation with *rote-learning* and *rule-following*. Each describes the practice, a mode of learning, which is opposite and antithetical to the 'joy of discovery'. Play is fun. Other aspects of work could be further elaborated: it leads to resistance. (p. 38).

Our current image of mathematics as something that is unattainable with little or no practical value for the average person in combination with a lack of positive mathematical experiences in the classroom stifle a person's desire and motivation to learn. Also schools and teachers have historically used fear and humiliation as motivation for learning and this has contributed to our

negative perceptions of mathematics, or learning in general.

However, when it comes to learning mathematics, motivation and attitude are vital to success. In many cases, attitude is as important as aptitude. Nevertheless, because of our image of mathematics, most of our attitudes about mathematics are negative and function to create the cultural and social perception that mathematical illiteracy and innumeracy are commonplace and acceptable, the norm. Because of these norms, math has no value and therefore there is no desire or incentive to learn. For example, let's take a cognitivist view of the mind as a computer and use computer metaphors to describe learning. Cognitivists consider our brains as hard drives in which we can upload and download information. However, just like a hard drive, the brain can only hold a limited amount of information. Let's assume that by some new technology we could plug our brains into a computer and easily download mathematical information and skill thereby taking away all the hard work, time, and pain associated with learning mathematics. Because our historically, culturally, and socially constructed attitudes and perceptions of mathematics are so negative and math has no value, most people would still not load any mathematical knowledge, and instead save that space for something they consider more relevant and practical. The problem is in our current reality, learning mathematics is very rigorous and time-consuming. Therefore, how can we inspire students to put in the work necessary to learn mathematics when many could care less about the knowledge, even if it was easily up-loadable?

How can we change the image of mathematics?

How can we change the image of mathematics or our perception of mathematics so that students would desire this knowledge and be motivated to learn? According to Sherrie Reynolds (2005), "perception is not a simple matter of taking in the world. It is a complex reconstruction of it" (p. 264). Therefore, our first steps in finding a solution is to better understand how and why

these negative views have been constructed, and formulate ideas on how we can change these negative views into positive views. However, our culture and society views mathematics very negatively, therefore changing our views and orientation to mathematics could be a very ambitious task. Nevertheless, students need to “fundamentally change their orientation toward mathematics from seeing it as a series of disconnected, road rules to be memorized and regurgitated, to a powerful and relevant tool for understanding complicated, real-world phenomena (Gutstein, 2006, p. 30). In order to change the image of mathematics, we must expand the way we look at mathematics curriculum and pedagogy and maybe consider a more postmodern view. Smitherman in *Chaos and Complexity Theories* posits that by "deconstructing the underpinnings of knowledge and the assumptions that accompany information allows for interpretive frames to expose the limitations of such knowledge as well as to stimulate new perspectives and new approaches to learning" (p.172).

The deconstruction of traditional mathematical and educational philosophies has exposed many of their limitations. Although we have this information, many people still view mathematics and mathematics curriculum and pedagogy as fixed and rigid. For example according to Jardine,

suggesting that the whole is never simply given suggests an image of education itself: that our already established understanding of the world is never established and fixed once and for all, but is necessarily open to the arrival of the young. (2006, p.195)

Just as simple linear models failed to find solutions to complex nonlinear problems, traditional mathematics curriculum and pedagogy fail to consider the complexity of education. However, postmodernism asked us to consider mathematics and education as dynamic and evolving, similar to Madeleine Grumet's (1988) and William Doll Jr.'s (1993) description of curriculum as

dynamic and moving. Everything must evolve in order to survive because change is inevitable. According to St. Julien (2005), "education is complicated, everyone agrees... Something that was done yesterday, in yesterday's circumstances, with yesterday's students, does not have the same effect when repeated today. The situation is not stable" (p.101). However, we still use, essentially, the same methods as we did 200 years ago.

Today, the postmodern philosophy of mathematics has become associated with many of our contemporary theories on education, mathematics, curriculum, pedagogy, and learning. According to St. Julien (2005), many of these theories hold great promise for education and may be helpful in envisioning the influence of a complex analytic on the pursuit of educational goals" (p.112). In William Doll Jr.'s *Curriculum beyond stability*, and *A post-modern perspective on curriculum*, he discusses how chaos and complexity theories can be used for interpreting matters of curriculum. Fleener (2005) posits, "chaos and complexity are perspectives of New Science and postmodern inquiry that may implicate significant changes in how we understand and approach curriculum studies" (p. 1). In addition, Smitherman (2005) posits that

through metaphors associated with chaos and complexity theories, new visions for curriculum can emerge. Rather than viewing education in a sequential form in which the teacher is a dispenser of knowledge, one can envision theories and practices of education in nonlinear ways. (p. 176)

"The notion of curriculum as a linear progression of accumulating subtopics to reach the whole can no longer be effective in fractal world" (Wang, 2005, p. 303). "Learning occurs in nonlinear patterns, emergent, divergent, convergent" (Smitherman, 2005, p.168). According to Wang (2005), "William Doll (1996), in his vision of nonlinear teaching, brings forth the notion of throwing out a seed, rich with problematics, to initiate the iterative interaction among teacher,

student, and text” (p. 305).

Fusing heterogeneous fuzzy topics for clustering into lessons and classroom activities.

According to Ernest, mathematical knowledge in the traditional sense is "isolated and discrete knowledge, different in kind from all others" (2009, p. 46). This perception of mathematical knowledge is probably why we teach mathematics as if it was a separate subject isolated from all others and why mathematics curricula are constructed and viewed as isolated and discrete. However, in *The way out of educational confusion*, Dewey posits that one of the major reasons why education fails is because of the “segregation of subjects” (p. 38). Nevertheless, the traditional mathematics curriculum, used in most schools today, consists of various discrete mathematical topics broken down into subtopics that are typically viewed by the students as isolated from reality. Furthermore, although people are different, the traditional mathematical pedagogy uses the same cookie-cutter methods to teach everyone. However, the new postmodern philosophy of mathematics considers mathematical knowledge as "joined up with and inseparable from other areas of knowledge” (Ernest, 2009, p. 46). Mathematics is all around us, we see it, and sometimes deal with it, on a daily basis. However, many people may not see it because of the influence of the modernist framework that functioned to isolate mathematics from everyday life. Nevertheless, mathematics has tentacles that reach in every direction, and if I had to think of one subject that is the most connected to all others, it would be mathematics.

Therefore, maybe it's time we dissolve the traditional boundaries between academic subjects by teaching math across the curriculum. For instance, instead of teaching just mathematics, maybe we can teach music with an emphasis on a particular mathematics topic or teach mathematics with an emphasis on geography, literature, social studies, or history.

According to Peterson (2006),

as a result of trying to implement 'math across the curriculum' – and in particular, integrating math and social studies – ...students' interest and skill in math have increased, both in terms of their understanding of basic concepts and their ability to solve problems. Furthermore, they can better clarify social issues, understand the structures of society, and offer options for better social policies. (p.15)

Since one of my main concerns is creating more student interest and desire in the learning of mathematics, I feel that teaching math across the curriculum is very promising. With this in mind, I would like to expand on the idea of teaching math across the curriculum by suggesting a concept of teaching mathematics using the analogy of fusing heterogeneous fuzzy topics for clustering.

Traditional clustering is very similar to our traditional mathematics curriculum because they both partition a set of objects into self-similar groups. For example, a child does clustering when he or she divides a set of wooden blocks according to color. When using this type of clustering, however, a block is red or it's not, it's blue or its not, there is no in between. All blocks are either 100% red or 100% blue. If there happens to be a block that is a combination of red and blue, where do we put it? Where would we put the block if it was 50% red and 50% blue? Under these circumstances, traditional clustering would fail. Another example is if we consider the statement "about 5." When using conventional set theory or hard sets, an element such as $\{5\}$ is either completely in or completely out of the set and therefore the statement "about 5" makes no sense. The problem is "about five" is fuzzy or vague. However, fuzzy set theory, introduced by Lotfi Zadeh in *Fuzzy sets*, provides a mathematical structure for handling this vagueness. For instance, a fuzzy partitioning is where the members of each subset (cluster) bear

more similarity to each other than they do to the members of other subsets. Therefore, all members of subsets may have various degrees of membership in each cluster and a fuzzy c-means algorithm can be used to determine the clusters and the partial membership of each element in these clusters.

Fuzzy c-means clustering of numerical object data was introduced by Dunn (1973) and developed by Bezdek (1973; 1981) as a fuzzified version of an earlier clustering technique known as hard c-means developed by Ball and Hall (1967). The move from hard c-means to fuzzy was due to the influence of postmodernism and the fact that there are many advantages to using a fuzzy approach. For instance, hard c partitions are all or nothing, black or white, meaning an element is either in the set or it is not and there is no gray area. The concept of the hard c-means is very similar to the way we think about mathematics curriculum because when considering the different topics taught in school, each student is either studying math or not studying math. However, fuzzy logic expands this notion by changing the underlying assumption that the clusters are hard or crisp to the assumption that they are fuzzy and this amounts to allowing elements various degrees of membership or partial membership in each set or cluster. The same can be true in teaching mathematics because there are various degrees of overlap in mathematical topics and the topics in many other subject areas. However, if we could use the analogy of the fuzzy c-means method of clustering we could let a mathematical topic become the cluster center and then allow other subjects partial membership in each cluster. In addition, topics in other subjects could represent the cluster center with various topics in mathematics having partial membership in the cluster. There would be an infinite number of combinations. The teacher may suggest what topic makes up the cluster center and then have students discuss the many subtopics that surround this cluster.

In the classroom setting, students would not sit and listen to a lecture but would be actively involved in the learning process. As John Dewey suggests in *Experience and Education* students learn by doing. For instance, Dewey asked his students to imagine they were running a store and have them performing the various activities associated with running a store that would give them numerous opportunities to learn and practice their mathematical skills. People could imagine they worked as a carpenter or in a machine shop or as a tailor thereby learning the basics of measurement. For example, by reading basic measurements from a tape measure, students can learn the concept of fractions and conversions from the English system to the metric system. While working as a bookkeeper, students can learn to write and perform basic mathematical operations. Students learning auto mechanics have the opportunity to learn many of the principles associated with mechanical engineering including but not limited to hydraulics by working with jacks and brake cylinders. Also, these students learn about basic electronics by working with starters and basic electronic components. According to Davis, "Dewey noted, people are far more likely to learn when they are thoroughly occupied and engaged in what they are doing" (1996, p. 219).

Therefore, we should try and relate reading, writing, math, and social skills to applications in many different fields. We need to consider a dynamic transformative pedagogy that helps people reach their full potential. However, according to Doll, this requires a certain pedagogy, not the pedagogy of mimesis (copying) but the 'pedagogy of practice' wherein the practice is not mere repetition but the practice of doing, reflecting, visioning, doing yet again with a 'difference.' Such a pedagogy is one of transformation, of transforming an individual's nascent, natural instincts, interests, powers, abilities into mature, reflective, successful, and productive ones. A curriculum

organized around such practice – itself honoring the play of performance and the performance of play – is dynamic, not stagnant. Like a play, the performance has structure but also flexibility as a performer (the '*currere*' running the curriculum course) interacts with the audience and the other actors (the environment). The play (or curriculum) becomes transformed as it is produced by the players acting and interacting. ... "A dynamic, emergent curriculum, transformative in its processes, sees both the learner and the curriculum (child and curriculum, in Dewey's phrasing) having their own voice. The point counterpoint of this duet/dialogue, with practice and overtime, produces transformative results. (2005, p. 55)

"In many ways, the severance of thought from feeling is an odd one, especially for those of us who, like young children, have retained the capacity to be excited about what we do and do not know" (Davis, 1996, p. 208). Nevertheless, the number one objective should be to prepare students to succeed in a variety of situations.

Conclusion.

Throughout this chapter, I have considered the role that the grand narrative of mathematics has played in our social and cultural acceptance of mathematical illiteracy and innumeracy and how this acceptance legitimizes power relations. I have considered that our traditional "beliefs form the cornerstones of modernity that affect all aspects of our social lives including our educational, political, economic, and social institutions" (Fleener, 2005, p.7). Nevertheless, postmodernism has had a serious impact on our traditional philosophy of mathematics. For instance, we have moved from a positivist to a post-positivist philosophy and then from a post-positivist to a new or postmodern philosophy of mathematics. Today, because of this constant flux, the very foundations of mathematics are in question and this creates an

environment where the teaching of mathematics is an extremely difficult task. For example, who wants to learn something that someone says may not be around tomorrow. However, postmodernism has opened up an entirely new world of mathematics that was once never considered possible. According to Stanley (2005), "asymmetry, chaos, and 'fractal' forms are the 'new order' of the day" (p.139). Although sometimes change is hard, Trueit (2005) "hopes that chaos and complexity theories ...[will be the] tools to help us to think about and to deal with, change – not by rearranging what is present, but by looking for what was not there before" (p. 95).

"Just as the mathematics of the seventeenth century was integral to the formulation of Descartes' philosophy, so the mathematics of today is making a vital contribution to the reformulation or understanding of the universe" (Davis, 1996, p.14). However, Rotman (1993) warns us that as we move away from the traditional mathematics of the past and expand our understanding of computational chaos and complexity theory as well as fractals, "computer science threatens to supplant physical science as mathematics' prime external source of problems and abstractions" (p. 149). According to Davis,

while the debate rages on as whether such branches of inquiry as chaos theory and fuzzy logic are indeed mathematics, these areas of study have served to demonstrate that mathematical knowledge is not preexisted; nor does it exist in any one of us. Rather, it emerges from our actions in the world from our interactions with one another. (Davis, 1996, p.74)

"The new fallibilist philosophy reveals mathematics as human, corrigible, historical, and forever changing. Mathematical knowledge is fallible and eternally open to revision, both in terms of its proofs and its concepts" (Ernest, 2009, p. 52). According to Wolfe (2014), *recognizing the*

chaotic, fractal nature of our world can give us new insight, power, and wisdom.

The traditional mathematics of the past has created an environment where the perception of mathematics is very negative, and this has a serious impact on our motivation and desire to learn. However, when considering a new postmodern philosophy of mathematics, we see promise in the possibility of changing the image of mathematics in a positive way.

Postmodernism has shown us that everything is in a constant state of flux and therefore our social and cultural views and perceptions of mathematics could change. For instance, according to Swetz (2009), “cultural trends in mathematics are constantly evolving” (p. 13). "Culture represents the popular will as to what is important at a particular time. As culture changes, this perception of societal importance and priorities also changes” (Swetz, 2009, p. 26). Therefore, because math and culture are ever changing and very dynamic, it is possible that our cultural perceptions and attitudes about math could also change. This gives us hope that if we work as diligently as possible, then maybe someday no one will be mathematically illiterate and innumerate.

By considering many of the concepts associated with computational complexity theory, chaos, nonlinear dynamics, and fuzzy systems, we can formulate new ways of looking at mathematics education. For instance according to Davis (2005),

rather than maintaining the frustrating quest for fundamental particles and basic principles, the new sensibility is to embrace the particularity and complexity of forms at whatever level of organism or organization one chooses to study – whether it be neuron, individual learner, classroom collective, social group, culture, species, or whatever.

(p.124)

By considering postmodernism and many of its concepts concerning mathematics, we begin to

understand that

the knowledge, skills, and attitudes listed in curriculum guides are not fixed and final and given and meant simply to be delivered. Rather, such matters are, by their very nature, susceptible to a future (new questions, concerns, evidence, applications, transformations, additions, reinterpretations, explorations, occlusions, discovers, happenstance is, and so on) that is still arriving. (Jardine, 2006, p. 211)

According to Rotman (2000), "fractals, complex dynamical systems, dissipative structures, [and] deterministic chaos, represent fundamentally new, *nonlinear* forms of mathematics" (p. 74).

Hopefully these new ways of looking at mathematics will help us to advance education and the learning of mathematics in the future.

CHAPTER 7

ENVISIONING A DIFFERENT WORLD OF/IN/WITH MATHEMATICS

Throughout this investigation, I have been examining why we view education, mathematics, and learning the way we do in the United States, and how these views, many of which are negative, have created an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate when a lack of this knowledge can function to control, enslave, exploit, and oppress. As I looked at my various issues from a cultural studies postmodern perspective, I began to notice how our views on education, mathematics, and learning, have been historically, socially, and culturally constructed and reinforced. I have witnessed how power is associated with the construction of these attitudes and perceptions, and the impact these views have on our motivation and desire to learn and the teaching of mathematics. Many of these views are why mathematics education in the United States has become a major social issue with serious practical and policy implications. These skills and knowledge are necessary for a person to make informed educated decisions. Therefore, I find it hard to believe that overwhelming numbers of people lack mathematical knowledge and ability and although this can cause an extreme hardship on them and their families, we still consider this socially and culturally acceptable.

Although I am sure that it was never intended, mathematics has become another one of Lyotard's grand narratives used for the purpose of legitimizing power relations. The grand narratives of mathematics are useful in some ways and oppressive in others. For example, mathematics is useful because it has a certain utility in society and can help us to see the world in new and different ways. However, the idea of fixed rules and procedures and the power of mathematics to claim certain truths can function to oppress. For example, low scores on

standardized tests, can be used to restrict a person's access to resources and thereby function to reproduce the status quo. One thing is for sure many of these grand narratives have been designed and used to legitimize cultural reproduction and domination. These narratives or myths have constructed negative views of mathematics that convince people that they don't need any mathematical knowledge or ability because mathematics has no practical value and that poor math skills are the norm. The problem with this premise is a lack of this knowledge and ability can be very detrimental to a person's success.

As a mathematics teacher, I would have to say that most of the social problems associated with mathematics are a result of these views. Therefore, by considering mathematics as political text we can see that these narratives have become major components in the mathematical hegemony perpetuated on the masses used to manipulate, reproduce, and control. During this exploration, I have looked at mathematics from a curriculum studies point of view and noticed just how mathematics has become associated with domination, power, reproduction, resistance, and hegemony and how although many of these historically, socially, and culturally constructed views are the result of natural evolution, some have been constructed for sinister hegemonic reasons. People such as Antonio Gramsci (1971), Henry Giroux (1981, 1983), Michael Apple (1979, 2004), and Paulo Freire (2004) have given us some insight on how this reproduction is carried out and why people resist. Paul Willis has given us a look at resistance firsthand in his text *Learning to labor* (1977).

Therefore throughout this chapter, I attempt to critically analyze and formulate my conclusions concerning my questions and issues and attempt to envision a different world of/in/with mathematics. For example, I have come to the conclusion that our historically, socially, and culturally constructed views are the reasons why we view mathematics the way we

do and why we find it socially and culturally acceptable to be mathematically illiterate and innumerate. I have witnessed the many contradictions between how we are conditioned to view mathematics and reality, and who benefits. For example, I have come to the conclusion that there are people or institutions that benefit by having an uneducated populace. As Scott (2012) reminded us in *How Higher Education in the US Was Destroyed in 5 Basic Steps*, “the corporations, the war-mongers, those in our society who would keep us divided based on our race, our gender, our sexual orientation” all benefit in some way by having an uneducated populace. Although I can’t see why we as a society have allowed education and mathematics to become gatekeepers, Joel Spring argues this is nothing new because historically “educational policies have served the interests of those wanting to take advantage of others” (2004, p. 1). Knowledge is associated with power and wealth, therefore, some people will do everything in their power to obscure that knowledge from the masses no matter the consequences. In Freire & Macedo’s 1987 text *Literacy: Reading the Word and the World*, they argue that the people in power use their power to control education in order to maintain the status quo.

Throughout chapter 3, I have considered mathematics as racial and gendered text and have gained a better understanding of how power is associated with the construction of our attitudes and perceptions concerning the race, gender, social class, education, and the learning of mathematics and of the role that race and gender have played in historically, socially, and culturally constructing our beliefs, desires, values, and attitudes about education and mathematics, as well as how these views have functioned to legitimize, reproduce, and reinforce racial, gender, and class relations. For instance, we have seen that there are people who wish to control and oppress and it is in their best interest to keep the masses uneducated because education is the great equalizer and a threat to their power. Keeping the masses uneducated,

discouraged from learning, or at the very least controlled by some narrative or hidden curriculum makes it easier to control, oppress, and exploit. Since education is associated with empowerment, liberation, and labor power, it is in the best interest of those with power to make sure they control education and the flow of knowledge or information available.

By considering mathematics as racial text, I have determined that historically education and educational policies concerning Native Americans, African Americans, and other minorities has been about control. Scholars such as Anderson (1988), Gutstein (2006, 2009), Watkins (2001), Spring (2004), Fordham and Ogbu (1986), and Jordan (1974) have given us some insight on how race is used to rationalize intolerance and they all are seriously concerned about how schools in the United States have been used as a means of social and economic control of African-Americans and many other minorities. A person with no education has no labor power and therefore can be easily exploited economically. Today that control is carried out by our historically, culturally, and socially constructed views of education and mathematics that have functioned to legitimize and reproduce gender, racial, and class relations and stifle any desire to learn and become educated. For example, I find this rather disturbing because historically African Americans, Native Americans, and other minorities have known that literacy and formal education are a means of liberation and freedom however our historically, socially, and culturally constructed views convince them otherwise. For example, although most African Americans, Native Americans, and other minorities consider education very important, they choose not to learn because they have been conditioned through hegemony, anti-intellectualism, and other environmental factors to feel this way.

Also in chapter 3, scholars such as Walkerdine (1998), Jacoby (2008), Tobias (1993), Appelbaum (1995), and Brush (1980) have helped us to better understand many of the issues

concerning gender, and how our culture and society have shaped our views about the characteristics and abilities of men and women that seriously impact education and the learning of mathematics. For example, they have helped us to see that science, medicine, social and cultural narratives, and the hidden curriculum have functioned to construct, reinforce, and make legitimate many of the stereotypes and perceptions about the ability of men, women, and minorities when it comes to learning mathematics. Our cultural and social views of math as a hard, strict, and a rigorous subject, which in many cases is difficult for men, creates the perception that math is too hard for women. These views are why so many people still believe that mathematics is a male oriented subject and women just can't do math. Therefore these views have a tremendous impact on the number of girls seeking to learn mathematics and although there is no evidence that women or minorities can't do mathematics most of the populace have been conditioned to believe it true. These views have become so embedded in our culture that today many people view them as the norm.

Today, it is no longer morally, socially, culturally, or politically acceptable to condone racism or sexism; however, there are some who still hold to the views of the past and that is why today racism and sexism are carried out in sly, covert, and subversive ways. For example, education, mathematics, and the testing movement have become the new obscure and hidden means of perpetuating racism and sexism by constructing and reinforcing all of the characteristics, stereotypes, myths, and stories concerning race, gender, and social class that are used to discriminate and oppress. All of these have worked to create negative attitudes and perceptions of mathematics and education that are still very prevalent today, and have a serious impact on a person's motivation and desire to learn. These historical stereotypes have had a profound effect on education because many students still fall prey to negative racial or gender

stereotypes that convince them they cannot do well in mathematics. Therefore, it is hard to deny that education and mathematics have been used historically, and are still used today, as gatekeepers to weed out the so-called inferior and reinforce and reproduce inequality and the status quo, many times, in terms of race, gender, and social class. Although this amounts to the cultural and social acceptance of discrimination and exploitation based on mathematical ability, nothing is ever done about it.

To make things worse, today standardized tests have taken over as a means to establish a racial, gender, and class hierarchy used to discriminate. For example, “quantitative tests of aptitude and achievement have given U.S. education a way to sort children by race and social class, just like the old days, but without the words 'race' and 'class' front and center” (McDermott & Hall, 2007, p. 11). Although the intent of these tests were to insure that students reach some minimal level of ability and not be left behind, in the age of accountability, these tests have become a means to discriminate and oppress and are responsible for many of our social issues concerning education and mathematics. Test scores classify people in terms of inferior and superior status with the intent of creating what Freire calls the “other” to rationalize the social, cultural, and economical oppression of those considered inferior. We have seen the racist history of standardized tests and how these tests create a barrier or gateway, a form of discrimination hidden from view. Low scores in school and on standardized tests can restrict a person’s access to higher education and possible socioeconomic success.

Also in Chapter 3, I discussed the association between the achievement gap, social Darwinism, and the eugenics movement and how these associations help to establish a motive for why mathematics is being used as a tool to discriminate, exploit, and oppress. Test scores function to reinforce and perpetuate stereotypes in terms of race, gender, and social class and

function as a means to discriminate, exploit, and oppress, a gatekeeper to restrict access to higher education and social mobility. The use of standardized tests in an attempt to hold teachers, students, and institutions accountable has resulted in the control and oppression of many. Today, education, mathematical knowledge, and standardized testing are associated with capitalism and used as a means of labor stratification. Furthermore, from my experiences as a mathematics teacher, I don't believe that standardized test scores give us any useful information and the only reason why we still use them is because as Taubman has suggested, "they result in huge profits for several companies such as McCraw Hill, IBM, Pearson, and ETS K – 12" (2009, p. 20).

Many people fear standardized testing because the pressure of these tests produce a dislike for any subject, and since mathematics is such an important part of these tests, it is easy to see why so many people have such negative perceptions of the subject. However, I have come to the conclusion that a lack of this knowledge can cause more of an economic hardship on students, not because of some test score, but because this knowledge could give them the power to function in society. I can say that our historically, socially, and culturally constructed values, perceptions, and norms of mathematics determines the amount of motivation people have to learn math and since many of these views and perceptions are negative, masses of people have no desire to learn and as a result mathematics becomes a gateway. Until the masses obtain the mathematical knowledge, basic level of numeracy, and critical thinking skills necessary to critically analyze and process the numerical information that is disseminated throughout our society and culture, as well as be successful on standardized tests, mathematics will continue to be used and perceived as a form of oppression. Although many of the theories of the junk sciences such as social Darwinism and the eugenics movement have been debunked, they have been so firmly embedded in our culture that they are extremely difficult to eradicate.

Since the learning of mathematics and mathematical development are functions of intellectual labor, it is important to understand how our historically, socially, and culturally constructed views about learning, education, and mathematics have been strongly influenced by intellectuals, anti-intellectuals, and anti-intellectualism. In chapter 4, I discussed the role that intellectuals, anti-intellectuals, and anti-intellectualism have played in constructing our social and cultural views of mathematics that function to reinforce our social and cultural acceptance of mathematical illiteracy and innumeracy. With the help of scholars such as Antonio Gramsci in his *Prison Notebooks* (1971), Noam Chomsky in *The Responsibility of Intellectuals*, Edward Said in *Representations of the Intellectual* (1994), Thomas Sowell in his text *Intellectuals and Society* (2009), Syed Alatas' *Intellectuals in Developing Societies* (1977), and Marla Morris in *Jewish Intellectuals and the University* (2006), to name a few, I have learned what it means to be an intellectual and why the dominant establishment has worked very hard at creating false myths and stereotypes of intellectuals as troublemakers and a danger to the status quo which functioned to create a negative perception of an intellectual in the eyes of the public.

Those in power view intellectuals as a threat to their power because the intellectual may question or criticize and in doing so cause others to also notice the injustice inherent in their policy or policies. Nevertheless, in *The Responsibility of Intellectuals* (1967), Noam Chomsky argues that the responsibility of intellectuals is to speak the truth and expose lies. However, in carrying out their responsibility, they are many times exposing injustice and disrupting the status quo and that is why anti-intellectuals and the dominant power portray intellectuals as people who ask too many questions and are subversive, dangerous, and pose a serious threat to society and democracy. Although I have always viewed an intellectual as a caring and compassionate positive force in society who values education and knowledge, fights for the less fortunate, and

speaks out against all injustice, I have noticed for a long time now, that there are many groups that express discontent and hatred towards intellectuals.

Isn't it interesting and somewhat suspicious that people who work in fields such as mathematics and science are many times not considered intellectuals? Nevertheless, in the eyes of the average person they are considered intellectuals and therefore face the same discontent and hatred as any other intellectual. Although there are some who admire and respect intellectuals, there are many who despise them. This could be because many intellectuals are considered elitists and viewed in Marxists terms as members of the bourgeoisie because of their association with academia or their social status. The association with the elitist view of an intellectual and academia has resulted in an environment where our socially and culturally constructed attitudes and perceptions of intellectuals, education, and mathematics are very negative and run rampant in our culture and society. For example, since many intellectuals are perceived by the public as connected to academia in some way, many of our socially and culturally constructed views of education, mathematics, and learning are a direct or indirect result of our views of intellectuals.

Until this study, I never realized the derogatory nature of the word intellectual. It was after reading about the Dreyfus affair that I realized that the term intellectual was associated with the anti-establishment and because of this many intellectuals are often shamed or alienated. Many anti-intellectualist narratives portray intellectuals or people who are informed and educated as enemies to capitalism with communist and socialist beliefs and are considered to possess certain negative characteristics or traits not seen as socially or culturally acceptable by the masses such as cruel, rude, devious, lying, selfish, snobbish, greedy, cheating, power hungry, sexually deviate, egocentric, cowardly, alcoholic, drug abusing, intolerant hypocrites. Intellectuals of all types are considered socially inept, liberals, egg heads, bastards, nerds, geeks,

and geniuses, who are insane, effeminate, schizophrenic, ugly, weird, and even stupid. This could be why in the United States “academic and scholastic, instead of being titles of honor, are becoming terms of reproach” (Hofstadter, 1962, p. 380). Nevertheless these images of the intellectual have become so firmly embedded in our society and culture that today all intellectuals are viewed as evil, crazy, or part of the lunatic fringe and in most cases if someone calls you an intellectual they are not attempting to be flattering, but demeaning.

Many of these negative views of intellectuals have been propagated by anti-intellectualism and have created an environment where people considered intellectuals are persecuted and treated as second class citizens. My suspicion is that these views are a byproduct of the ongoing battle between intellectuals and anti-intellectualism for the control of the masses. For instance, anti-intellectuals believe that thinking and learning are trouble and can lead people to unhappiness and sinfulness and have worked very hard at socially and culturally constructing many of our negative views and perceptions of intellectuals, education, and mathematics. Anti-intellectuals are responsible for creating the perception of intellectuals as flawed and since mathematics is somehow associated with intellectuals, people who are good in mathematics are also perceived as flawed. People who are good in mathematics have to have something wrong with them, because why would any rational person study such a thing? In many cases, these people are persecuted and treated as second class citizens even though many work diligently to make society a better place. Negative attitudes and perceptions about intellectuals have led to negative attitudes and perceptions concerning mathematics and no matter how far from the truth these views may be, because of these perceived associations, the motivation to learn and study mathematics is almost nonexistent.

Throughout my analysis, I have considered mathematics as institutional text and come to

the conclusion that our various cultural and social forces, mathematics as a discipline, and our traditional mathematics pedagogy and curriculum all play a role in constructing and shaping our views of mathematics and the learning of mathematics. For example, I have witnessed the influence of our social and cultural institutions such as schools, teachers, the family, peer culture, mass media, popular culture, and big business in constructing and reinforcing our perceptions, attitudes, and stereotypes about mathematics, mathematics education, and people who possess mathematical ability, that have a serious impact on mathematics education, curriculum, the teaching and learning of mathematics, and our motivation and desire to learn mathematics. In chapter 5, I discussed how many of these institutional forces have great power in constructing, shaping, and reinforcing our culture, society, and identities and have created views of mathematics that are so negative that math has no intrinsic value and therefore there is no interest, motivation, or desire to learn. However, as a mathematics teacher, I can truly say that when it comes to learning mathematics, motivation and attitude are vital to success.

I have witnessed the power of schools and teachers in constructing and shaping a person's views of mathematics. For instance, early American schools used fear, punishment, and humiliation to control classroom behavior and to motivate students to learn things for which they had no interest and this probably accounts for why historically, mathematics has been, and is today, associated with anxiety, fear, and hate. Giroux (1983) and Apple (1979), through their correspondence theory have given us insight into how institutional propaganda reproduces the economic and political order of society, and that institutions such as schools work to reproduce the dominant ideology, many times by using a hidden curriculum. They argue however, that although schools are institutions used to reproduce the dominant culture, students still find ways to resist. Gutstein (2006), described how Chicago area public schools educated the majority of

their students for “low-skilled service-sector jobs or the military” (p. 211).

We have seen in the film *Stand and Deliver* how much power that a teacher has in helping their student’s to learn. We have also seen how teachers can impact their students in negative ways by expressing to their students negative attitudes about subjects or topics. “Teachers do not have to be directly biased in conveying these beliefs; they are too often so subtle as to be unconscious or unintentional” (Gay, 2009, p. 200). Nevertheless, according to Morris in *Jewish Intellectuals and the University* (2006), “teachers do make a difference! Teachers impact our youth in profound ways. Teachers shape the future of the country. Teachers shape our children. Teachers inspire youth” (p. 7). In addition, the major movements in the history of curriculum and curriculum studies discussed in chapter 2, have all played a role in constructing and reinforcing our historically, culturally, and socially constructed attitudes, perceptions, and norms concerning education and mathematics that have a serious impact on our motivation and desire to learn. For instance, we have seen the influence of our traditional pedagogy in using a transmission or product model in the teaching of mathematics where students are instructed through lecture and use rote memorization to learn the signs, symbols, signifiers, and rules of a series of unconnected pre-specified topics through drill and practice that have little or no relevance in the lives of students. This type of pedagogy typically results in passive students who were not actively participating in their own learning and often times wished they didn’t have to sit through the agony of the class. Furthermore, when students rely on rote memorization, they usually never acquire any conceptual understanding or learn how to do math, and what they do learn they soon forget. However, the Coleman Report (1966) shows that social status, the family, and peers have more influence on academic success than the curriculum and teachers.

Throughout this study and my experiences as a mathematics teacher, I have witnessed how people have constructed and reinforced their views of mathematics from previous experiences with mathematics. For example, I have witnessed the power of teachers in constructing and shaping a person's views of mathematics in terms of their competence, confidence, and self-esteem that function to shape their mathematical identities and the pleasure or power they may achieve in the learning of mathematics. Although curriculum and pedagogy does play a role in the construction of our views of mathematics, I have come to the conclusion that teachers make the biggest difference both positively and negatively. A good teacher has the content knowledge to be successful and is caring, compassionate, upbeat and enthusiastic about mathematics with the ability to inspire, encourage, and motivate by helping students develop confidence and a positive self-esteem concerning their ability to learn and be successful. However, a bad teacher lacks the necessary content knowledge, usually doesn't care about their students, and plays a very influential role in conditioning their students to view mathematics negatively. Some of these teachers even express their negative views of mathematics in front of their students.

Previous experiences with quizzes and tests also contribute to how we view mathematics. For example, assessment or evaluation are perceived as forms of punishment and humiliation, something done to them by someone of power, something to be feared, and where failure and incompetence are to be avoided. Most of my students never look positively at any mathematics test or quiz. In fact, overwhelming numbers of my students consider any test or quiz a bad thing. These types of views function to promote emotional reactions to mathematics and mathematics tests that play a serious role on a student's motivation and desire to engage in learning

mathematics. Therefore, evaluation typically has a very negative impact on student motivation. However, I have used methods to evaluate students where the students never know they are being evaluated or assessed thereby avoiding the emotional response. For example, we have seen the importance of Davis' (1996) conversation to help students learn and to determine student strengths and weaknesses and therefore conversation can be used as a method of evaluation. By asking the right questions it is possible to find out what students know and do not know.

For example, I have used a pizza party as a method to evaluate students understanding of fractions and parts of a whole. I order several pizzas and have each pizza cut into a different number of pieces. On the outside of the box, I write the number of slices in each box. I have the pizzas facing away from the students so that they have to look at the number on the box to select their slice. I often ask questions like do you like pizza or do you not like pizza? Some students tell me that they love pizza therefore they would like a big piece and select the box. If they pick a box with smaller slices, they may not have a full understanding of parts to a whole. Of course a pizza cut into eight slices has bigger slices than a pizza cut into twenty slices. It is very important that we find non-traditional ways to evaluate what students know.

We have to understand that teachers, pedagogy, curriculum, and assessment or evaluation may all contribute to the lack of positive experiences in a mathematics classroom and this lack of positive experiences seriously impacts a person's motivation and desire to learn. The problem is most Americans have never had any positive experiences with mathematics from kindergarten through college and the lack of positive experiences is why most U.S. adults, fear, loathe, and hate mathematics. Therefore, all teachers must be aware of their influence and impact on how their students will view mathematics and work to become positive role models, and make sure all of their students have positive experiences in a mathematics classroom.

I have gained a better understanding of the role that the family plays in the construction of our positive and negative views of mathematics and the importance of the parents in providing support and help in the teaching of their children. A person's family and peers are very influential in creating a unified view of mathematics in both positive and negative ways and all play a role in the construction of our identities, attitudes, and perceptions concerning mathematics that have a serious impact on the teaching and learning of math. People such as Fordham and Ogbu (1986), Appelbaum (1995), Walkerdine (1998), and Moses and Cobb (2001) give us some insight on the role of the family and education and how the family may influence students in a bad way even though it was never intentional. Typically if a person's family is positive about mathematics, it will rub off on others and they will develop positive attitudes about mathematics. However, if people in the family are negative about mathematics, they may influence others to be negative. The same goes for a person's peers. The problem is today in our society and culture, "many students cannot admit to pleasure in classroom activities – it just would not be acceptable in front of their peers" (Appelbaum, 1995, p.128). Since math is unpopular, mathematical ability and the learning of mathematics is not considered cool, and I don't know too many people who would like to feel that they were not cool. Hence, to be cool a person should avoid learning mathematics or anything not considered cool for that matter. People want to fit in and be part of the in crowd, however, if they are perceived as good in mathematics by their peers they may lose their popularity status and are often bullied, ridiculed, embarrassed, and humiliated.

After considering what individuals or institutions have the most power in constructing, shaping, reinforcing, and legitimizing our social and cultural norms, I would have to say that the mass media, as discuss in detail in chapter 5, is by far the most influential. Although our

families, peers, and teachers have a great deal of power in shaping how we view the world, they too have been conditioned by the mass media. The ability to reach large numbers of people at the same time gives the mass media the power to control any discourse and shape any narrative thereby shaping and controlling the outcome of just about any issue, good or bad, true or false. As I reflect on my past experiences with mass media, I can see the power of the mass media to construct, shape, influence, and control our thinking and actions, social and cultural norms including our values, morals, beliefs, and desires as well as our identities. I have noticed the power of the mass media in transforming minds and imaginations and controlling how you view yourself and others, as well as the image or perception others have of you in society. Most people never realize the power of the mass media in constructing and shaping our personal identities, mathematical identities, social identities, and national identity.

Throughout this investigation, I have gained a better understanding of the role that the mass media plays in constructing our historical, social, and cultural views using grand narratives or meta-narratives to reproduce the dominant ideology and culture, socially control the masses, and advance the capitalist system by creating a mass consumer culture using various stories and myths to create a unified outlook for the purpose of reinforcing particular attitudes, perceptions, and stereotypes concerning schools, education, learning, mathematics, mathematics education, and people who possess mathematical ability that have a serious impact on our motivation and desire to learn. Many of these stories or myths are communicated through oral dialogue, radio, music, movies, television, newspaper, magazines, books, or various other media, and function to legitimize our social and cultural norms concerning mathematics by creating a perception that math is hard, most people can't do it, people good in math are not cool, and mathematical illiteracy and innumeracy are socially and culturally acceptable. For example, in films such as

Stand and Deliver, *Hidden Figures*, *21*, or *A Beautiful Mind*, all help to create representations good and bad that have a serious impact on how people perceive mathematics, mathematics education, or people who are good in mathematics as well as a person's desire or motivation to learn.

The mass media designs, produces, and distributes various texts for the purpose of constructing and reinforcing negative perceptions of mathematics, the learning of mathematics, or school. Through a critical examination and deconstruction of various cultural products or discourses used to shape our mathematical identities, I have witnessed how anti-intellectualism, popular culture, and the mass media construct, shape, and reinforce our attitudes, perceptions, and desires to learn math. They create a hegemonic mass consciousness as a means to dominate and control, by convincing the masses to believe what the dominant power want them to believe without ever knowing the truth, or noticing how they are being conditioned and controlled. Throughout this investigation I have gained a better understanding of how the mass media is being used as a means of social and cultural control continuously constructing popular culture politically, socially, and economically by manipulating and normalizing social and cultural norms that for many would seem contradictory. For example, almost everyone would say that education and the learning of mathematics are important, however many times the media encourages people not to learn.

We should all pay attention to how the mass media uses their broadcasting power to socially and culturally control the masses by spreading propaganda and misinformation many times based on junk thought and pseudoscience in order to create particular points of view, manipulate, and divide and conquer. The mass media are professionals at using a divide and conquer technique that keeps various groups distracted so they never realize their oppression.

This continued conflict leaves no time for people to meditate or reflect on their situations. Therefore, by creating conflict, the mass media can more easily maintain social control. For example, the mass media have been responsible for creating and reinforcing many of the racial conflicts of the past and present as well as most of our views concerning mathematics. For example, many of the issues we have concerning race, gender, social class, and mathematics have been stimulated and exacerbated by the corporate media in order to keep us in fear, divided, and in conflict thereby guaranteeing the status quo.

Throughout chapter 5, we have seen how anti-intellectualism articulated with the mass media and corporate order can shape every narrative, control the flow of knowledge, shape our cultural and social views and manipulate our popular culture and youth culture by convincing them to rebel, that adults, teachers, or anyone believed to be in authority are the enemy, and that it's cool to be dumb. All of these institutional forces have used stories and myths to create representations of reality, that have nothing to do with reality and only function to construct and reinforce a corporate capitalist economy and negative perceptions, attitudes, and stereotypes about mathematics or people who possess mathematical ability and skill that seriously impact the teaching and learning of mathematics and create an environment where it is socially and culturally acceptable to be mathematically illiterate and innumerate. In this way, knowledge could be readily available to all, but no one would want to seek it. What a unique form of hegemony.

During this study, I have attempted to explore the teaching of mathematics at a time when the very foundations of mathematics are in question. I have investigated the impact of postmodernism on the current field of curriculum studies and mathematics and have determined that postmodernism has changed the philosophical discourse on the nature of mathematics as

well as how we view mathematics curriculum and pedagogy by questioning our traditional views of mathematics and the teaching and learning of mathematics. Postmodernism has changed the way we look at the grand narrative of mathematics as something universal and absolute and asked us to consider that all knowledge is dynamic, evolving, and socially and culturally constructed. We've seen how the grand narrative of mathematics and the many narratives used to construct and reinforce our perceptions of mathematics have been used to legitimize power relations and the status quo. Through the deconstruction of various anti-intellectual narratives, I have noticed how these texts are used to legitimize many of our social and cultural norms concerning the learning of mathematics that have a serious impact on our motivation and desire to learn as well as the teaching and learning of mathematics.

In chapter 6, I have discussed our current image of mathematics and its impact on our motivation and desire to learn. Some of these views have been constructed by anti-intellectual narratives containing propaganda and misinformation meant to mislead and control, and some have been constructed from previous experiences with mathematics and the learning of mathematics. Our overall image of mathematics, however, is probably constructed by a combination of these different influences. However, our current curriculum and pedagogy have also played a very influential role in the construction and reinforcement of our negative views of mathematics that adversely affect our motivation and desire to learn. Therefore it is imperative that we change our views of mathematics. However, since our culture and society view mathematics very negatively, one of the most ambitious goals is to change our orientation to mathematics. Nevertheless, this study has opened my eyes and helped me to understand that there are things we can do to change our current image of mathematics and orientation to mathematics in order to make learning desirable.

For example, current scholarship in curriculum studies and mathematics has convinced me that a change in pedagogy and curriculum is necessary if we hope to change our views of mathematics and create a desire for such knowledge. These theories and concepts have allowed us to better understand how to integrate a mathematics curriculum with many other subjects by using and applying the ideas, concepts, and notions of the new postmodern philosophy of mathematics such as complexity and chaos theory, nonlinear dynamics, and fuzzy systems. I feel that these ideas will help to create positive social and cultural views of mathematics and increase a person's motivation and desire to learn. These ideas in combination with John Dewey's ideas of linking the teaching of subjects or topics to a person's past experiences will help to increase a person's interest, desire, and motivation to learn. In addition, after considering the process, discovery, praxis, process-oriented guided instruction models of pedagogy, I now have available paths to start to incorporating curriculum as conversation and the teaching of mathematics for social justice.

Envisioning a different world of/in/with mathematics.

Throughout this study, we have witnessed how our historically, socially, and culturally constructed views of mathematics have become a form of domination, a tool for social and economic control, prejudice, and discrimination, a gateway that restricts a person's access to power, economic success, and prosperity many times in terms of race, gender, and social class. Therefore, I envision a different world of/in/with mathematics where education, mathematics, and standardized tests are no longer used as a gateway to weed out certain individuals or as a tool to discriminate, oppress, or exploit. A world where we tear down the historically, socially, and culturally constructed barriers that restrict or limit a person from reaching their full potential. For example, once students learn the mathematics needed to exist and flourish, standardized tests

would no longer have the power to control, discriminate, oppress, or exploit.

Although I understand that mathematics can be used in a discriminatory way, as a gatekeeper to enslave, exploit, and oppress, I also understand that mathematics can result in empowerment, liberation, economic access, and full citizenship. Therefore, I envision a different world of/in/with mathematics where mathematical knowledge and ability empower and liberate students. A world where people are mathematically empowered by having the “language, skills and practices of using and applying mathematics” (Ernest, 2002, p.1). A world where no one is mathematically illiterate or innumerate and everyone has the ability to recognize and understand basic mathematical signs, symbols, and operations, as well as the necessary problem solving and critical thinking skills necessary to function in society. A world where everyone has the knowledge and ability to process the vast amounts of information we see daily. A world where mathematics is no longer used as a form of misinformation and propaganda associated with the junk sciences or pseudoscience to obscure the understanding of issues and convince people to take action on the basis of flawed mathematical calculations or flawed statistical data.

I envision a different world of/in/with mathematics where mathematical illiteracy and numeracy are no longer considered the norm and everyone breaks free from the mathematical hegemony that has become so embedded in our culture. A world where a lack of mathematical knowledge and ability can no longer enslave, exploit, and oppress because everyone is liberated and empowered by their mathematical literacy and numeracy and are able to use this knowledge to combat inequality and to fight for social justice. A world where we consider "mathematical literacy as critical literacy for the purpose of transforming society, in its entirety, from the bottom up toward equity and justice, for all students whether from dominant or oppressed groups" (Gutstein, 2006, p. 11).

I envision a different world of/in/with mathematics where people consider many different views of mathematics and not just the Platonist, positivist, or post-positivist view. A world where people no longer view mathematics as some meta-physical, static, absolute, universal, eternal, or unchangeable entity that exists throughout the universe independent of humanity. A world where people understand that mathematics is constructed by people through physical and social interactions in order to help us to become more human and create a better world by presenting new ways of seeing and being in the world. A world where new postmodern philosophies of mathematics have made their way into our curriculum and pedagogy and have functioned to create positive views and images of mathematics that help us overcome the motivational obstacles concerning mathematics and enhance student learning by creating an environment where students are autonomous and self-determining individuals with the curiosity, competence, confidence, perseverance, motivation, and desire to learn.

I envision a different world of/in/with mathematics where math has value and people are highly motivated to learn the mathematical knowledge and skills necessary to survive and thrive in any environment. A world where students have a high level of competent motivation and where the fear of punishment and humiliation are no longer the primary motivation to learn. A world where mathematics no longer evokes feelings of anxiety, fear, and hate and where fear is no longer a form of social control and oppression. A world where mathematics as a discipline, curriculum, teachers and pedagogy, previous experiences with mathematics, and high pressure testing, are no longer perceived as a means to punish and humiliate. A world where punishment and humiliation are no longer used as motivation to learn and where no one hates mathematics because we can all live in harmony with mathematics.

I envision a different world of/in/with mathematics where schools have access to high

numbers of qualified mathematics teachers with the passion and adequate amount of mathematical content knowledge to successfully teach our students and as Gramsci had hoped would help in the construction of a counter hegemonic revolutionary class. A world where teachers attend to the needs and interests of the children, as well as teach subjects that would be useful to all citizens. A world where mathematics is relevant to lives of most students and where students actively build new knowledge from previous experiences and knowledge. If we can change our social and cultural views of math, maybe then we can introduce our students to the beauty and transformative nature of mathematics, make math relevant to their lives, and motivate more students to study math.

I envision a different world of/in/with mathematics where schools and teachers make sure their students learn the mathematics necessary to survive and function in the world by creating positive mathematical experiences that encourage their students to learn mathematics. A world where a person's family is a valuable component in helping students to develop positive views of mathematics and positive mathematical identities. A world where a person's peers and their peer culture no longer considers education or the learning of mathematics detrimental to a person's popularity status but as an asset or something of value. A world where the mass media constructs stories and myths that function to shape and produce positive perceptions and attitudes concerning mathematics and the learning of mathematics that help to increase a person's motivation and desire to learn. A world where teachers or adults are no longer seen as the enemy, but as friends and mentors and where it is cool to be smart and no longer cool to be dumb.

I envision a different world of/in/with mathematics where anyone perceived as good in math, mathematicians, scientists, intellectuals, or anyone considered educated and informed are no longer considered to have something wrong with them or be a danger to our culture and

society. A world where these people are no longer considered flawed in some way or possessing characteristics or traits deemed as socially and culturally unacceptable. A world where these people are no longer humiliated, persecuted, and treated as second class citizens even though many work diligently to make society a better place. A world where intellectuals, mathematicians, and scientists are cherished and no longer seen as a threat but as an asset and where anti-intellectualism no longer has the power to influence our motivation or desire in acquiring mathematical and scientific knowledge.

I envision a different world of/in/with mathematics where mathematics is no longer unpopular and where a lack of mathematical knowledge is no longer considered cool and perceived as a badge of honor. A world where people flaunt their mathematical knowledge and ability as a badge of honor because our society and culture considers it cool to be good at math. A world where no one ever says "I can't do math" or "I have never been a math person." On the bright side, math is ever changing and very dynamic and luckily our perceptions and attitudes about math may also be changing. Throughout this study I have viewed mathematics through the frameworks of curriculum studies and have gained a better understanding of mathematics curriculum as historical, political, institutional, racial, gendered, and postmodern text. It is hoped that I can use some of these ideas and theories to become a better teacher and inspire students to learn. If we can inspire people to learn mathematics, many of our issues associated with mathematical knowledge and ability would become things of the past.

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