THE PRIVILEGE OF PEDAGOGICAL CAPITAL:

A FRAMEWORK FOR UNDERSTANDING SCHOLASTIC SUCCESS IN MATHEMATICS

by

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ABSTRACT

The theme that runs through this work is three-fold. First, there is a quality that some students possess that enables them to arrive at the academic table better positioned to take advantage of our educational offerings. This work seeks to forward for general vocabulary usage a name for that quality so that we as educational researchers can acquire it as a tool not only in the field of mathematics research, but analogously in all subject areas. The term being introduced is pedagogical capital. Secondly, as educational standards in mathematics become the rubric upon which the success or failure of teachers and schools are measured, it is important to consider whether these curriculum standards contain the seeds of social justice or hegemony. If mathematical standards convey an unconscious privilege to one group at the expense of another, then equity is at issue. And finally, as a new and emerging theoretical framework, the concept of education in this work uses Pierre Bourdieu's sociological idea of a firmly grounded, true mixed-methods approach of using both qualitative and quantitative data to highlight one detail in the overall picture of what is currently the portrait of mathematics education.

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INTRODUCTION

Overview and Background

Several years ago, on a school field trip to the Huntsville Space and Rocket Center, I climbed a rock wall. One section had large, closely spaced hand- and footholds, while the other two sections had successively smaller and more sparsely positioned holds. The first section was much easier to climb, and I had been advised by my students to climb that section and to avoid the other two sections. But being me, I had to try, and it took me several tries before I was able to successfully climb all three sections. Eventually, I achieved each pinnacle, rang the bell, and then descended from the rocky tower. That rock wall serves me as an analogy for schools and for the hand- and footholds students use as they maneuver toward scholastic success. For most members of society, school plays a central role educationally. It is the primary place, and for many the only place, where the logical practices and systematic supports—those hand- and footholds—that construct a person's education occur. The quality of the education built in each student is summed up collectively as scholastic success. Success gets quantified—and even qualified—along a spectrum of low to high, with some falling into a murky category called under-achievement due to life's vicissitudes. Unlike my multiple attempts at the three sections of rock walls, for the most part we do not get multiple attempts at nor do we get a choice of which section of the wall we are to climb as we complete our education. What we are offered, however, is a scholastic wall to climb. Whether the hand- and footholds are personally and judiciously placed is a function of the Bourdieuian field and cultural capital present when and where one arrives at birth.

The concept of education in this research rests on Pierre Bourdieu's notion that scholastic achievement is directly related to access to and participation in logical practices and systematic supports that form various types of capital. That field of capital is related to the interplay of education with the individual. It can be called a resource for access much like those hand- and footholds allowed me access to the top of the tower. Access implies a threshold or point of entry. According to Bourdieu, we enter a field of play at birth much like a payoff matrix. Participation implies not only crossing a threshold, perhaps many, but also becoming involved in a logical practice, nay a series of logical practices, that eventually construct an education. Call it the luck of the draw, but for some students, the hand- and footholds involved in scholastic success in mathematics are not positioned advantageously. Or as Bourdieu would say, all households "do not have the economic and cultural means for prolonging their children's education beyond the minimum necessary for the reproduction of the labor-power" (Bourdieu, 1986, p. 245) found in the home at the time of the child's rearing. Bourdieu considered the "domestic transmission of cultural capital" (Bourdieu, 1986, p. 244) to be the best-hidden and possibly socially most important educational investment that can be made in a child. In this paper, pedagogical capital will be advanced as a subtype of cultural capital and used as a framework for understanding some logical practices and systematic supports that lead to scholastic success, and in particular, scholastic success in mathematics.

The following questions guided this empirical and qualitative research:

1. Is there any empirical evidence that would show that the mathematics curriculum has areas of privilege for those with pedagogical capital over those without it; for

instance, are there any elements in the *Alabama Course of Study: Mathematics* where children in possession of pedagogical capital thrive while their peers who do not possess adequate pedagogical capital struggle to or fail to demonstrate scholastic success in mathematics?

2. Can the term pedagogical capital, as an unconscious privilege possessed by some students and as an ideology in its own right, which is being advanced for general vocabulary usage, offer a compelling qualitative interpretation for some scholastic success in mathematics?
3. Would this privilege be in keeping with the equity principle as outlined by the National Council of Teachers of Mathematics in their *Principles and Standards for School Mathematics*?

Bourdieu summed up his theory of logical practice in two words. Those two words are "irresistible analogy" (Bourdieu, 1980, p. 200). The term analogy is based upon the Greek word *analogia*, which implies a comparison with specific regard to a relationship. In linguistics, the use of an analogy is a process by which words or phrases are created, or re-formed, according to existing patterns in the language such as when a child says foots for feet or says flower-works for fireworks. In this way, new words can be formed that may fall into general usage, in this case, pedagogical capital. In logic, an analogy is a form of reasoning in which one thing is inferred to be similar to another thing by virtue of an established similarity in other respects as in that any four-sided geometric figure is a quadrilateral, but a square is a special type of quadrilateral. In this way, new words also fall into general usage, and again in this case, pedagogical capital. But proportionately speaking, logical analogies are deductive and tend to follow from an immediate past very similar to legal precedent, whereas linguistic analogies are inductive and tend to create, like a new precedent perhaps unveiled just at that moment, an immediate and thereafter-visualized future. One analogy is a threshold from the past and the other is a threshold to the future. Together they form a bridge.

Because Bourdieu connected his sociological ideas to his empirical research, a fairly rare combination in philosophy, he consistently bridged a threshold from a grounded past to a theoretical future that is high in social utility. His theory of practice creates an irresistible analogy with regard to how the function of *habitus* re-creates its own field of play—or in other words, the same hand- and footholds (or payoff matrixes) constantly reappear in successive generations—grounded as it is in the subtleties of grammar, ritual and other logical practices. In this research, the Classic Grounded Theory approach was the vehicle by which these subtleties emerged. Influenced by human capital theory, Karl Marx and perhaps even Mao Zedong, Bourdieu asserts through strong grounded theory and empirical correlation that each individual finds himself located in a social space demarcated by the types of capital fluidly or statically in possession at any given time, rather than by class alone (Bourdieu, 1986). A theoretical underpinning of this research was Bourdieu's idea that in order to be used successfully as a source of power or to direct researchers attention to areas of unconscious privilege for one group over another, the subtypes of cultural capital are in need of being identified and legitimized.

Summary

To that end, this research addressed and forwarded for general vocabulary usage one specific form of cultural capital, that is, pedagogical capital, as a subtype of cultural capital that offers an unconscious privilege to those students who possess it. Using a combination of sociological ideas, empirical research and justifiable correlation, the notion of pedagogical capital was used as a theoretical framework for understanding some logical practices and systematic supports that lead to scholastic success. For the purposes of this research, that scholastic success was in the area of mathematics, but this same style of analogy should predictably emerge in other scholastic fields. It is hoped that by use of irresistible analogy—and I will be generous in using the analogy of climbing up the rock wall—it was derived through empirical analysis (inferential statistics) and qualitative analysis (Classic Grounded Theory) that students who possess pedagogical capital displayed evidence that they entered some fields of educational play, particularly in conjunction with the mathematics curriculum, with a higher probability of becoming scholastically successful due to the relation and interplay of Bourdieu's notion of *habitus*, the distribution of cultural capital within the family, and the standards and norms of the institution.

Introduction of the Problem

The scholastic success of economically disadvantaged students in mathematics continues to be one of the greatest challenges faced by mathematics teachers and mathematics policymakers. Studies have consistently shown that a student's social and cultural background routinely influence whether that student will perform well in mathematics (Lamb, 1998). While prior reform efforts have brought to the surface the extent of the problem in mathematics education with regard to race or gender issues, there has been little success in the area of social and cultural disadvantage. Johnson (2002) asserts that "changing content and performance standards without fundamentally transforming educators' practices, processes, and relationships cannot lead to success" (p. 11). Thus, newly derived efforts aimed at eliminating achievement gaps and cultivating a culture of equitable scholastic success in mathematics in our schools needs to begin to acquire the tenor of meaningful and thoughtful educational discourse surrounding areas of potential privilege that continue to perpetuate conditions of underachievement among economically or otherwise disadvantaged students.

Scholastic Success in Mathematics

Although there is no standard definition of scholastic success in mathematics, it is fairly well documented that more school failures are caused by mathematics than by any other subject and has been thus for decades (Wilson, 1961; Aiken, 1970; Lamb 1998). For the purposes of this research, the performance descriptors of the math general rubric for the Alabama Reading and Mathematics Test (ARMT) were used as quantifiers for scholastic success in mathematics (Alabama Department of Education, 2005). These levels are:

Level I	Does not meet academic content standards: Demonstrates little or no ability to use the mathematics skills required for Level II.
Level II	Partially meets academic content standards: Demonstrates a limited knowledge of content material.
Level III	Meets academic content standards: Demonstrates a fundamental knowledge of content material.
Level IV	Exceeds academic content standards: Demonstrates a thorough knowledge of content material.

These four levels of achievement mirror the style of indicator used by the US Department of Education on state education reports, with those four levels being Below Basic (Level I), Basic (Level II), Proficient (Level III), and Advanced (Level IV) (2005). Since Levels III and IV of the ARMT general rubric are the scores awarded to students who meet the requirements of being either at or above grade level in mastery of prescribed content standards, with regard to this research, these two levels were said to constitute students who are demonstrating scholastic success in mathematics.

Changing Demographics

Mirroring the population of the United States as a whole, the population of students in our public schools continues to be predominantly of European ancestry, but as time passes, that proportion is constantly declining. What population reports show is that beginning in the 1990's, the growth of all racial/ethnic groups increased with the exception of the white child. At the beginning of that decade, white school children accounted for 73.6% of the total school population, but by the end of the decade this demographic cohort had declined to 68% (Gordon, 1997). There was a corresponding increase in the traditionally minority populations. Black and Hispanic children, particularly, are two to three times more likely to be living in poverty than white children (Hobbs & Stoops, 2002). Who our disadvantaged and marginalized students are, and what needs that they present, affects which issues related to education are most important for research. The American Educational Research Association (AERA), as the nation's leading research organization concerned with the production of knowledge related to education, has committed itself "to disseminate and promote the use of research knowledge and stimulate interest in research on social justice issues related to education" in their social justice mission statement (AERA, 2006). Indubitably, any striking demographic shift in the US population will significantly alter the diversity and ethnic breakdown of the student population in the public schools. Social issues regarding those emerging critical mass populations as they are in the process of change should not be discounted.

For instance, the state of Texas has undergone, and continues to feel the effects of, a major demographic shift in its student population. This change will significantly alter the diversity and breakdown of the student population in its public schools. Murdock *et al*. (2000), in a study of a mostly Hispanic demographic shift in Texas, maintained that major demographic trends and analyses serve to underscore the need for continual educational reform that will effectively confront and address the root causes of the elements that continue to generate performance gaps between student groups in public schools. Murdock was able to project the Texas demographic population trends from 2000 to 2040 comparing Anglo, Black and Hispanic populations. It is important that educational research address not only the school of today, but also the school of the future if that seems at all predictable.

While not as startling as the Hispanic demographic shift in Texas, Alabama is undergoing a similar change in its student population. In a report on state education indicators with a focus on Title I, the US Department of Education (2002) compiled the following data for Alabama's 1,135 public schools, as shown in Table 1:

Table 1

Alabama State Education Indicators with a Focus on Title I

Race/ethnicity	1993-1994	1999-2000	% increase/decrease
Am. Indian/Alaskan Native	5,906	5,141	13.0% decrease
Asian/Pacific Islander	4,320	5,195	20.3% increase
Black	259,700	265,300	2.2% increase
Hispanic	2,781	7,994	187.5% increase
White	453,268	445,852	1.6% decrease

As shown by the data, Alabama is experiencing a similar shift in the demographic make-up of its student populations. Also, during the year 1999-2000, the percentage of students eligible to participate in the Free/Reduced Price Lunch Programs were reported in Table 2:

Table 2

Alabama schools by percent eligible for the Free Lunch Program[a]

Percentage of students eligible	Number of schools at level
75 – 100%	257
50 – 74%	390
35 – 49%	320
0 – 34%	381

[a]19 schools did not report

There were no data available for comparison with the 1993-1999 Free/Reduced Price Lunch Program eligibility specifically for Alabama. However, for the nation as a whole, the percent increase from 1996 to 2005 changed from 34% to 42 % for 4th graders, and from 27% to 36% for 8th graders (US Department of Education, 2005). If the socioeconomic differences between white and minority populations continues to shift in the direction that trends are heading, Murdock *et al.* (2000) contends, “The changing demographics of the South could lead to populations that are increasingly impoverished and lacking the human capital necessary to compete effectively in a global economy” (p. 8).

Also complicit in the changing demographics of American public schools is the sexual activity of women who delay or forego marriage. According to the National Center for Health Statistics, almost 4 in 10 of the nearly 4.5 million babies born in the United States during the year 2005 were born to unwed mothers (Centers for Disease Control, 2006). This represents the highest rate of out-of-wedlock births on record as the percentage has risen a full 12 points since 2002, and will potentially be the trend population demographic mirrored in the public schools beginning five years from now, as those children begin their school careers. Woman-headed households are among the poorest of the poor everywhere in the world. So rather than simply concentrate endless efforts on the symptoms surrounding the achievement gaps that, at best, produce minimal advancement for economically disadvantaged students, mathematics teachers and policymakers should strive to create reform that effectively addresses the root causes; the economic future of the South and its quality of life will depend upon the scholastic success of these students.

Summary of Problem

There exist many explanations for why economically disadvantaged students are out-performed by their peers and why reform efforts have failed in the past. Cuban maintains that "reforms return (again and again) because policymakers fail to diagnose problems and promote correct solutions … policymakers use poor historical analogies and pick the wrong lessons from the past … and policymakers cave into the politics of the problem rather than the problem itself" (Cuban, 1990, p. 153). However, in order to truly provide all children, regardless of class, with an equal life chance, mathematics teachers and mathematics policymakers must confront and address some very difficult issues ingrained within the mathematics curriculum that adversely affect the performance of economically disadvantaged students, particularly if demographic trends point to the continued growth of that population. Amid the current rhetoric surrounding the rationale that no child is to be left behind, the school culture and any structural elements that might perpetuate the inequities of educational opportunity for students who are economically disadvantaged, either by race, culture or household portraiture, can no longer go unnoticed, nor can they continue to be politely dismissed.

Introduction of Theoretical Perspective

I first coined the term pedagogical capital for myself on the morning after the highly dramatic United States presidential election of 2004. That morning, newly re-elected George W.

Bush made a statement during a television interview, "I've just earned political capital, and now I'm gonna spend it." I had been toying with what to call a quality I sensed as a teacher that some students possessed, but for which we seemingly have no vocabulary in education. That quality is the idea that some students come to school more in possession of an intangible that allows them to experience scholastic success. Upon hearing his statement that morning, I snapped my fingers and said aloud, "That's what I'll call it … pedagogical capital." It, or that quality, was a general feeling that some of my students arrived at the academic table better positioned to benefit from the educational process than others. As I had informally interviewed other teachers, it was apparent to me that all teachers recognized this unnamed quality that some students possessed. For the students who have it, it acts as nearly a financial asset so linguistically it made sense to use terms from the provenances of both education and capitalism, thus pedagogical capital.

Edmund W. Gordon, EdD

An immediate search for the term showed that a member of the advisory committee for the Coleman Report (Coleman *et al.*, 1966) and one of the founders of the Headstart program, Edmund W. Gordon, had first advanced the term in the spring of 2001 (Gordon, 2001). As I read Gordon's extensive writings and did further research, it occurred to me that the term had not fallen into frequent usage, despite its potential for social utility. During a series of emails, Dr. Gordon agreed to allow me to interview him. After resigning from my teaching position in the summer of 2005 to pursue graduate work, I traveled to his home in Pomona, NY, to conduct a videotaped interview. Before I used the term, I wanted to make very certain that we were on the same theoretical page.

A quiet-spoken man, Gordon patiently answered the series of 14 questions I set before him. First among them was how he had come to consider education as an element of human capital theory and when had he begun to use Bourdieu's theoretical framework of cultural and social capital reproduced by *habitus*. It was Gordon who suggested to me that perhaps Bourdieu had been influenced by a short essay written by Mao (Zedong, 1937) on practices. Human capital theory is currently arising in the field of education as economic interests infiltrate. No longer do we have souls to educate, but rather we are readying human resources for later economic pursuits. They are not students; they are current and potential future assets. What Bourdieu added to human capital theory (Becker, 1993, Bourdieu, 1986) was to pull the fence away from purely self-interested economic exchange and to re-position the fence to include capital in its dis-interested guises of cultural and social exchanges.

According to Gordon, he stumbled upon Bourdieu largely from his exploration of what he considered our nation's major program of affirmative development, the *Servicemembers' Readjustment Act of 1944*—commonly known as the *GI Bill of Rights* (US Department of Veterans Affairs, 2006). He considers it to be the largest affirmative action effort in the history of the United States (Gordon, 2004). The components of the bill ensured that veterans of World War II had ample opportunity to improve the state of their education, health and finances. Admitting he now conceptualizes it as much more deliberate than perhaps it had originally been implemented, he saw a nation "poised on an almost revolution in its economic and industrial development" (Livingston, 2005). The reward for military service was the excuse, but the *GI Bill of Rights* had the affect of changing the culture from one that had recently arisen out of an economic depression, where many forewent education and thus the nation was not very intellectually oriented at the time. Millions of previously uneducated, undeveloped men and women were given the opportunity to be positioned ahead of everyone else in the world due to the veterans' preference programs which were enacted. "Most of these kids had been farm boys"

(Livingston, 2005) and they had not been equipped for the economic and industrial expansion that would occur in the latter half of the twentieth century. In other words, post World War II, the lucky ones had been in the field of play that had gone to war.

Bourdieu's work matched rather than influenced Gordon's thinking and got him to question, what are the varieties of things that position one to benefit from education? In 2001, Gordon referenced Bourdieu's (1986) idea that culture and social networks, along with reasonable health, other educated humans, and sufficient money are forms of capital that are invested in the development of successfully educated persons. Gordon contends that access to these varieties of capital are not distributed equally, and that it is access to them that provides a not too subtle supplementary education (Gordon, 1999, Gordon, Bridglall, & Meroe, 2005). The ability to place a child in the most desirable field is not in the realm of the school. In other words, the situations for individual children do not have the same payoff matrix. Given that little difference can be found in the material resources currently available in schools, there is an inferred association between the effectiveness of a school and the amount of supplementary education that exists outside of the school. Those authors referred to this supplementary education as a hidden curriculum. And viewing supplementary education as a resource, there are not many people who would argue against Gordon's logic of using pedagogical capital as a term when you are talking about human resources to invest in one's development. Gordon suspects it is the association with more traditional concerns around capitalistic provenance that keeps terms like "capital" and "human resources" out of the vocabulary of education (Livingston, 2005). However, the most effective schools seem also to be those populated with kids who grew up in highly and richly resourced environments—or those with an appropriate level of pedagogical capital.

However, Gordon was quick to agree that scholastically successful students could also come from modestly resourced environments provided that the parent provided an appropriate level of pedagogical capital—support for appropriate educational experiences outside of the school (Gordon, 2001). One of the examples of this that occurred is James Comers' little book, *Maggie's American Dream* (1989). Maggie was his mother, a domestic worker, who bore and raised him and his four other siblings. James is a physician and all of his siblings have graduated with doctoral degrees, having thirteen degrees between the five of them. "But Maggie brought a lot of pedagogical capital to the rearing of these kids" (Livingston, 2005). It seemed to Gordon that students who brought the wealth of these various capitals to complement the learning situation were bound to do better than students who were lacking them. Students who lack this out of school wealth suffered educationally just as though they were attending a poorly resourced school.

The Coleman Report

The Coleman Report, for which Gordon was a member of the advisory committee, created a controversy over families when it was released in 1966. In it, Coleman, *et al.*, asserted that variances in the quality of school alone did not adequately explain variations in levels of achievement. As a matter of fact, the authors advanced the idea that differences associated with the families accounted for most of the variance in school achievement (Coleman, *et al*., 1966). There was an understandably negative response from the minority groups highlighted in that report at the time, but missing in that action was the notion that the resources available to the majority families were not present or supported by the lifestyles of the minority families during the days of the civil rights movement. Those were the days when many school districts were still maintaining separate and unequal schools. Considering that the research in the Coleman Report resulted from an explicit directive written into *Public Law 88-352* (Eighty-eighth Congress of the United States of America, 1964), commonly known as the *Civil Rights Act of 1964*—and that it was one of the first forays into research related to educational policy rather than merely educational financing—it is understandable that issues having their root in the home were not given much consideration because they were not subject to institutional policy directives. As a quantitative report, the survey tallied such things about the family home as were there encyclopedias in the home, were there more than five siblings in the household, and had the mother graduated from high school. But due to the fact that the Coleman Report clearly showed that there were real and pronounced financial and policy disparities in need of address, particularly in the south where 54% of Negro school age children resided and were being schooled (Coleman *et al*., 1966), there began to be an over-identification of education with what occurred in the school and less identification with education as a cultural phenomenon occurring also within the family. Other researchers re-aggregated the data from the Coleman Report and were able to show that for minority students, the quality of school was far more important than family resources at that time (Pettigrew, 1967). This may have been because for many of the minority families, school was most likely to be the only place where the logical practices and systematic supports for academic learning took place.

This controversy did not faze Gordon, who by 1990 had developed a new construct he called affirmative development as a complement to various entitlement programs be it the *GI Bill of Rights* or Headstart (Gordon, 2001). Gordon conceived that the veterans' preferences program included affirmative development as well as affirmative action in the way of schooling, home loans, and other preferential treatments. The veterans were a protected group as much by public policy as by public patriotism. Having been influenced by the musings of W. E. B. DuBois, and even though skin color and other cultural identifiers continued to create problematic social divisions, by 2001, Gordon had become convinced that the unequal distribution of capital resources, the gap between those that have and those that have-not would be for the 21st century what racial and other social divisions had been for the 20th century. He had begun to believe that without the capital to invest in human development, it is impossible to achieve meaningful participation in our currently advanced technological society (Gordon, 2001).

Gary S. Becker, PhD

The best-known use of the terms human capital and human development in economics was a 1964 book by Nobel laureate, Gary S. Becker, entitled *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education*. According to Becker, human behavior adheres to the same fundamental principles as economic exchange. In his scenario, human capital is seen as a means of production as though each employee is an individual factory capable of producing labor. This was different from the Marxist notion that workers merely sell their labor power for wages. On a macro level, human capital can be substituted and should be considered as a separate variable in the production function. One can invest in human capital and raise the quality of it as when an employer offers education benefits, training or medical treatment because the quality of human capital owned is directly related to that investment. As a matter of fact, for the employer, income will depend partly on the rate of return on the human capital owned at any one time (Becker, 1993). Thus, human capital is an asset like stock, whose value can rise and fall depending on the state of the field of the employees at any given time in the present or in the future.

The concept of human capital can be infinitely elastic, including hard-to-measure aspects such as personal capital (for instance, efficacy and disposition) and social networks (via family or fraternity). This can and does vary from employee to employee and are to be considered at the micro level. However, Becker distinguished only between specific and general human capital and thus allowed the theory of human capital to work without explaining the difficult to measure. Specific human capital refers to skills or knowledge that is useful from a single employee as in knowing how to create blueprints. General human capital such as literacy or mathematical fluency is useful from all employees (Becker, 1993). However, it was the consequence of investing in human capital that was Becker's noteworthy contribution to the field of economics. The supply of human capital in a region can be used to show and explain regional differences that cannot otherwise be explained by way of the supply of economic capital alone. For instance, two sweater factories on the same size property, with the same machinery, climate, and raw materials can have as a result different qualities of sweater. The difference can only be accounted for in the quality of the worker manning the machines. Although Becker's analysis has at times been controversial, it has shown a high degree of utility in the way social environments are determined by the interactions of the individuals.

Leaning heavily on the writings of Bourdieu and Becker, Gordon summed up the sub-types of cultural capital that humans use for educational investment as:

1. *Personal cultural capital*: the collected knowledge, techniques and beliefs of a people.
2. *Financial capital*: income and wealth, and family, community and societal economic resources available for human resource development.
3. *Health capital*: physical developmental integrity, health and nutritional condition, etc.
4. *Human capital*: social competence, tacit knowledge and other education-derived abilities as personal or family assets.
5. *Institutional capital*: access to political, education and socializing institutions.
6. *Pedagogical capital*: supports for appropriate educational experiences in the home, school and community.
7. *Polity capital*: societal membership, social concern, public commitment, and participation in the political economy.

8. *Social capital*: social networks and relationships, social norms, cultural styles, and values. (Becker, 1993, Bourdieu, 1986, Gordon, 2001)

Gordon has not expanded on his idea of pedagogical capital as a subtype of cultural capital, nor has he begun any research into its possible effect. This was where my independent coining of the term picked up the thread where he had laid it down. Feeling certain that the two of us were on the same theoretical page, I concluded my interview with him, and we discussed the plans for my research. As a parting shot, Gordon countered my comment that pedagogical capital seemed to create an achievement gap that was much more difficult to document than those created by race, gender or socio-economic measures—measures which are easy to differentiate for measuring. He said, "It may be the only achievement gap that really matters" (Livingston, 2005).

Pierre Bourdieu: The Forms of Capital

In perusing the above list, human capital obviously involves more than just money. Most of the above is intangible and must be learned through the educative process of logical practices and systematic supports (Bourdieu, 1980). This is why racial isolation, gender isolation, and other types of isolation had the effect of lowering achievement pre-1964 and continues for those socially and/or economically isolated today. Like a not too subtly hidden Markovian chain (Parzen, 1960), these capitals are best utilized when the indulgence of "time gives it its form" (Bourdieu, 1980, p. 98), or in other words, these capitals have their substance in that the person adept at requisitioning them out does not bear the mark "of having been taught" (Bourdieu, 1980, p. 103) how to use them. There is a practical mastery that can be as simple as having the efficacy to call a well-placed administrator if a child is struggling that seems so effortless—like a learned ignorance of privilege ("*docta ignorantia")* (Bourdieu, 1980, p. 102).

In his seminal work, *The Forms of Capital,* Bourdieu (1986) outlines only three types of capital, economic, cultural and social. He makes the argument that the "social world is accumulated history" and that "capital is accumulated labor" (Bourdieu, 1986, p. 241). It is the process of accumulation that, borrowing a term from Newtonian physics, Bourdieu calls the *vis insita*, the power of the innate force of matter to resist change and continue in its present form. In other words, the accumulation becomes a native strength with inertia of its own. Accumulation differs from the distinction between inherited properties like color of skin or eyes and acquired properties like learned knowledge and "manages to combine the prestige of innate property with the merits of acquisition" (Bourdieu, 1986, p. 245). As a matter of fact, he also argues that the time necessary for accumulation is the *lex insita* (Bourdieu, 1986, p. 241), the principle or law underlying the inherent order of the social world. Things don't happen instantaneously as might with a game of roulette. Capital is the reason why not all scenarios are equally possible. It takes time to accumulate, it has a tendency to persist in its present state, and it is a force inscribed in the objectivity of things.

Bourdieu accounts for the structure and functioning of the social world by introducing capital in the non-economic forms of cultural capital and social capital (Bourdieu, 1986). Alluding to the historical invention of monetary capitalism, economics had academically reduced exchanges to those purely mercantile in nature, which are for profit and contain a high degree of self-interest. Left out of these exchanges were the dis-interested, non-monetary exchanges of the type that give structure to the distribution of types and subtypes of all capital in the social world. At any given moment, this distribution of both material and immaterial capital is able to paint a picture of the structure of the social world. If material capital in the form of money is said to exist, then implicitly defined and brought into existence is its opposite, immaterial capital in the forms of cultural capital and social capital. His leading argument for the existence of all three types of capital is the very real way that one type of capital can ultimately change form into a profit that appears as one of the other forms of capital. Bourdieu contends that capital and profits must be grappled with in all their types and subtypes in order to establish laws whereby they are convertible from one to another like Newton's laws of motion. Economic capital is most readily converted into money and can be institutionalized as property rights. Cultural capital, the underlying theme of this research, can be institutionalized in the form of educational credentials. Social capital is made up of connections and can be institutionalized as a title of nobility. In summary, capital presents itself in one of three types: economic capital, cultural capital and social capital.

The notion of cultural capital initially presented itself to Bourdieu "as a theoretical hypothesis which made it possible to explain the unequal scholastic achievement of children originating from the different social classes" (Bourdieu, 1986, p. 243). This starting point gave him a theoretical break from the view that academic success is an effect of natural ability and also provided a break from human capital theory that heretofore had been purely economic. Bourdieu goes on to describe cultural capital as appearing as one of three forms, embodied, objectified and institutionalized. He considered the embodied form of cultural capital to be dispositions of the mind and body which are accumulated and that are long lasting—his notion of *habitus*. The objectified form is where cultural goods take the form of accumulated pictures, books, dictionaries, etc. Cultural capital in its institutionalized form is a special type of objectification, for instance when it takes the form of educational qualifications that confer a type of real property of its own on an individual.

In his writing, Bourdieu gives credit to economists for directly questioning the relationship between the rate of profit and educational investment in human capital theory. However, he chides them for only taking into account "*monetary* investments and profits" (Bourdieu, 1986, p. 243) such as the cost of providing an education and the cash equivalent of time devoted to study. Not included or explained in human capital theory at the time were the ways different households, social classes, or other agents allocated their investment resources between the time needed for "economic investment" and the time needed for "cultural investment" (Bourdieu, 1986, p. 244). By not doing so, the economists had failed to systematically account for the way that the chance of profit differs as a function of time, or in other words, to account for that time which is needed for the total volume of the investment to play out as a component of the total field of assets available for input into that function.

They also neglected to relate the wide range of educational investment strategies to a total system of strategies that are able to re-produce those same strategies, and to comprise a logical theory of practice for that re-production. Ultimately, what was not included in human capital theory is what might be the "best hidden and socially most determinant educational investment, namely, the domestic transmission of cultural capital" (Bourdieu, 1986, p. 244). The empirical studies of the relationship between academic ability and academic investment diagramed in human capital theory (Becker, 1993) omitted the idea that ability is itself the product of a function between an interaction of time and cultural capital. Bourdieu called it a "typically functionalist definition of the function of education" (Bourdieu, 1986, p. 244) and claimed it ignored the idea that the actual scholastic yield from educational strategies will depend upon the cultural capital already invested by the household, class or other agent. Thus, embodied cultural capital is converted into an integral part of the person, or in other words, into a *habitus*.

Pierre Bourdieu: Habitus

To understand the concept of *habitus*, Bourdieu draws heavily on his fieldwork in Kabylia (Algeria). In 1974, after this fieldwork there had been completed, and during a series of elections in France while some editorial cartoons were being published in the local paper, Bourdieu discovered that the relationship between the native informant and the researcher did not allow for the transmission of unconscious schemes of practice. The explanations that natives offered for their own practices concealed even from themselves the true nature of their practical mastery of the schema, that is, they had a way of understanding that did not include the principles of practice or re-production of those practices (Bourdieu, 1977). To him, the natives were more possessed by their habits, than in possession of them, which he refers to as *habitus*. For instance, in gift exchange as in to denote the birth of a child or for a wedding, counter-gifting is a part of the overall scheme. What the natives failed to include in their explanation was the temporal element of this exchange, or in other words the time interval between the gift and counter-gift is what helps to define the whole truth.

Bourdieu explains that the social world is made up of three types of knowledge: phenomenological knowledge which is the explicit truth of the primary experience like the exchange itself, objectivist knowledge which structures practices and representation and makes the exchange experience possible, and lastly, scientific knowledge which explains the relation in which the exchange structures are actualized and tend to reproduce the same types of exchanges in the future. Bourdieu goes on to explain how the temporal element of the gift exchange answers inquiries into the mode of production and the practical mastery of the exchange schema (Bourdieu, 1977, 1980). Gifts countered too rapidly will curtail future exchanges or can be experienced as an insult in a similar way as with gifts countered too slowly. Models that abolish the interval between gift and counter-gift abolish the strategy also. For instance, in the scheme where a man is expected to avenge a murder or buy back property from a rival family and does not do so, after a certain interval, his personal capital is diminished on a day-by-day basis with the passing of that time. In the case of a when a bride is sought, the strategy schema holds that the exchange of negative answer gifts should come sooner than that of using the strategy of prolonging the anticipation of a positive answer gift. It is the theory of the practice of exchange, or the strategy used to decide when to exchange, therefore, which is the most specific aspect of the exchange pattern.

And it is this practical mastery of the theory of practice that is killed off by simple models of exchange and reciprocity when the temporal element is not adequately accounted for. A model rather brutally highlights what the virtuoso of the practice innately knows in order to produce the correct action at the correct time in each appropriate case. With rules or a model, reciprocity becomes a necessity, the product of exchange becomes a project, and things that have always just happened can no longer not happen. But in the real world of practical mastery, not every death is avenged nor is every gift countered—and nor must they be. There is a certain harmony of *habitus* that cannot be adequately re-produced in the model using mechanical laws for the cycle of reciprocity alone (Bourdieu, 1977, 1980). The passage from the highest probability that an action should happen to the actual completion of that sequence is both a quantitative and qualitative leap out of proportion to what the model reduces to a simple numerical gap that must be filled. There is a parable used by the Kabyle, “the moustache of the hare is not the moustache of the lion” (Bourdieu, 1977, p. 13).

This and similar parables, along with the temporal element inherent in exchanges transubstantiates a “disposition inculcated in the earliest years of life and constantly reinforced”

(Bourdieu, 1977, p. 15) by a series of checks and corrections from the entire group disposition or group *habitus*. In other words, the group as an aggregate embodies the dispositions of the individuals. Bourdieu was impressed that individual members of the Kabyle were unable to recite a litany of explicit axioms for the theory of practice, but they obviously had an inertial knowledge of the system that enabled them to re-produce it in its entirety in different locations and at different times. Thus the precepts of their customs had an unusual scientific underpinning in that they would "awaken, so to speak, the schemes of perception and appreciation deposited, in their incorporated state, in every member of the group, i.e. the dispositions of the *habitus*" (Bourdieu, 1977, p. 17). Rules and models are always a second-best to actual practice and are only in the group *habitus* insofar as they correct and make good the occasional misfiring of practice. *Habitus* is capable of generating practice without any apparent express regulation or any other institutionalized call to order. In a way that Bourdieu calls the fallacy of the rule, practitioners follow the rules without explicitly knowing them. The explanations natives may provide for their own practices include a learned ignorance (*docta ignorantia*) or a practical way of knowing the art of the game without any knowledge of its underlying principles.

Pierre Bourdieu: Structures, Habitus, and Practice

To understand what structures construct *habitus* and thus define the practice, one must examine the economy of the logic in use. One of the fundamental effects of the *habitus* is to produce a commonsense world of dispositions endowed with security due to a consensus of meaning. The word disposition seems particularly suited to express what is meant by *habitus*. It is broad enough to convey the meaning that the *habitus* is the product of an organizing action and it has a meaning that is close enough to that of words such as structure. What this means is that dispositions and systems of dispositions are not random (Bourdieu, 1977). For instance, a lack of money in a Marxist scheme would produce the habit of not buying books, i.e., “I have no money to buy books, and therefore I have no need to buy books.” In one way, it creates a virtue out of a necessity, but the organizing structure was the lack of money. If the underlying structure of the lack of money continues, and nothing else changes in the field either, the disposition will continue to be produced ad infinitum each time the opportunity to buy a book presents itself. Unlike the existentialist Jean-Paul Sartre, who made each action sort of an unprecedented confrontation between the agent and the world (Gregory & Giancola, 2003), Bourdieu was unable to dismiss the accumulative effect of these durable dispositions.

In other words, if one regularly observes a close correlation between the objective disposition, that is, the chance of access, and the subjective disposition, that is, the motivation or need, this is not because the agent consciously adjusts their aspirations to a mathematical evaluation of their chances of successful acquisition each time, it is because there is a propensity to privilege their earlier experiences (Bourdieu, 1977, 1980). Imagine for instance the difference between two students, one who has learned to take no for an answer and one who has learned how to whine in order to get his way. Structural exchanges must have occurred in each student’s past to give rise to each disposition, which helps to explain the current practice. In practice, the *habitus* is structural history turned into current nature, which through current interaction re-produces the actual production of the practice. Or as Bourdieu eloquently states, “it is yesterday’s man who inevitably predominates us” (Bourdieu, 1977, p. 79). The present is little when we compare it to our long past, which in the course of we were formed and from which we are the result. Thus *habitus* is structurally laid down in each agent by his earliest experiences and is the *lex insita* or underlying principle for current practice.

Pierre Bourdieu: Capital, Habitus, and Field

Bourdieu's is a philosophy of science that one can call relational. Although a characteristic with what are considered the hard sciences, relations are seldom incorporated into the field of play of the softer social sciences because objective relations are difficult to show. In this research, the term pedagogical capital is advanced as a subtype of cultural capital and used as a framework for understanding some logical practices and systematic supports that lead to scholastic success in mathematics. As such, it was important to understand the relation between the *habitus*, the field of play, and capital resources. It was accomplished via an irresistible analogy using a combination of quantitative and qualitative results. Capital, *habitus*, and field are the fundamental concepts of Bourdieu's social theory of practice. Economic capital and cultural capital work in conjunction to create a structural two-dimensional field of play (or a matrix) where agents are then able to interact. The first dimension, economic capital, is viewed as the most important because as a family finds itself with more of it, there is a higher likelihood that the family will also not be deprived of cultural capital (Bourdieu, 1998). His is also a philosophy of action designated at times as dispositional in order to note that the inertial potential inscribed on the agent and the inertial potential inscribed on the structure of the field that agents find themselves in is in fact a relation taking place in the temporal mode. The percentages of population engaging in a practice, such as playing golf or even consumption patterns, are not in and of themselves independent of the field.

In other words, the field (or payoff matrix) that agents find themselves in will likely be a determining factor in their practices and dispositions also. If this is drawn up as a map, distance on paper is equivalent to social difference and class difference. Bourdieu uses this analogy to explain left and right leanings in politics (Bourdieu, 1998). However, it is the structure of the capital, along with the relative amounts of economic capital versus cultural capital and whether or not certain subtypes of capital are present and to what degree, that can rather predictably determine what type of dispositions that the field is likely to produce now and in the future.

Pierre Bourdieu: Families

It seemed to Bourdieu that there was a new capital, which had taken its place alongside economic capital. He called this cultural capital. The structure of the distribution of both economic capital and cultural capital—and the re-production of that structure—is "achieved in the relation between familial strategies and the specific logic of the school" (Bourdieu, 1998, p. 19). Bourdieu considers families to be corporate bodies animated by a system of re-productive strategies that produces a similar family tomorrow and a still similar family in the distant future. In short, family is simply a word because there is no universal definition of family. The family contains a set of persons who share properties that include dispositions, social spaces, and capital. Bourdieu calls the interplay of the three the family spirit (Bourdieu, 1998). It is the combinatory relation between the three in one family with the three of another family that gives rise to our notion of class and success, sort of like east, west, north, and south on a map. According to Bourdieu, the family is the primary site of social maintenance and re-production. In other words, for the word family to even be possible, it must have some structural function in the social world. So what is it and how does it do it?

Families invest in a variety of re-productive strategies, for instance, fertility strategies, matrimonial strategies, succession strategies, economic strategies and educational strategies. Focusing on the educational strategies, families tend to invest more in school education as their cultural capital becomes more important to them and as the relative weight of their cultural capital to their economic capital becomes greater--or in other words, if schooling is a determinant in social position due to some economic reward, prestige, or mobility, then the family is disposed to find education important. Because the institution of the school is able to initiate social borders analogous to the old social borders that divided the nobility from the gentry, and the gentry from the common people (Bourdieu, 1998), some families are disposed to cross these class borders via education. But it is the family *habitus*, combined with economic and cultural capital, which tends to direct each successive generation to re-produce the same types of *habitus* in the next generation. Bourdieu never arrived at a theory for what causes one family to have a disposition of mobility and for another family to lack that disposition of mobility.

But if one looks at families as occupying a social space with a field of power, then the symbolic work necessary to produce a unified field is carried out by all members of the family, and possibly in particular by the parental unit(s). The inculcation of the child begins at birth. The parental unit(s), working in conjunction with the family field, have the time from birth onward to direct the flow of the student's *habitus*. Inculcation and assimilation take time, time that must be invested personally. Like the acquisition of a suntan or of a swimmer's stamina, it cannot be done second-hand. This rules out many of the effects of the school and community because delegation is thus impossible (Bourdieu, 1986, 1998). Therefore, the majority of the yield in the form of scholastic success depends on the cultural capital in possession of the family and on the amounts of that capital which is invested by that family. Eventual educational quality ends up being a relation between the inertial qualities of the family's accumulated capitals and those activities that occur in the school. Since we know that capital is unevenly distributed, all agents in the field of educational play do not have the same means to prolong or otherwise enhance the child's education. The embodied cultural capital and the embodied dispositions available in the family at the time of the rearing of the child stand the highest chance of being re-produced. If the cultural capital in the family is distributed in an academically friendly manner, that is if there is an appropriate amount of pedagogical capital, and if perhaps the family dispositions are mobile, then there is a higher probability that the family unit will produce a student for whom scholastic success will be the norm.

Ideology

The word ideology was first coined by Antoine Louis Claude Destutt, comte de Tracy, between the years 1801-1815 as a science of ideas (Head, 1985). Every society has ideologies that form the basis of public opinion and common sense. Dominant ideologies can appear to be very neutral, or if presented in a unique fashion, they can pack quite a sting. Antonio Gramsci advanced the notion that when most people in a society begin to think alike about certain matters, or to even forget that there are alternatives, then we arrive at the concept of hegemony (Bates, 1975; Purvis & Hunt, 1993). Michel Foucault wrote generously on the notion of ideological neutrality, and about the ways that dominant groups strive for power by influencing a society's ideology by broadcasting their own ideology, and therefore causing the society to become closer to what they want it to be (Rabinow, 1984). Karl Marx proposed that a society's basic dominant ideology presented itself as a part of its overall economic superstructure. This base/superstructure model is determined by what is in the best interests of the ruling class (Churchich, 1994). Karl Mannheim and Jürgen Habermas furthered Marx's view by showing that ideology is used as an instrument of social re-production (Somers, 1995). And then, after an intensive philosophical re-reading of Marx, Louis Althusser and Étienne Balibar proposed the concept of the lacunar discourse, or gaps in a discourse, to suggest that some dominant ideologies are not specifically broadcast, but are rather suggested by what is not told (Brewster, 1970).

Ideology then, as a form of cultural capital, has been extensively developed by Bourdieu as a mechanism of social re-production, and much like his concept of *habitus*, members of a society are generally more possessed by their ideologies than in possession of them (Bourdieu, 1977; Bourdieu & Passeron, 1979; Bourdieu, 1980; Bourdieu, 1986; Bourdieu, 1998). In this paper, pedagogical capital, as a yet unrecognized and perhaps unconscious privilege possessed by some, and as an ideology in its own right that might re-produce existing inequities, was advanced for general vocabulary usage in the hope that it might offer an alternative explanation for success and failure in mathematics education.

Equity

This past two-and-a-half decades has been witness to perhaps some of the most sweeping changes in mathematics education—not only in the content of mathematics, but also in the way educators and academicians present their material and develop student expectations. Since 1989, the National Council of Teachers of Mathematics (NCTM) has systematically developed a tripodal support system with its standards that seeks to create a balance between curriculum, teaching, and assessment. This approach is similar to the workings of a tripod table. According to the authors, adjusting one of the three legs can level the tabletop, or plane surface. Whether by design or coincidence, the authors of *Principles and Standards for School Mathematics* (*Principles and Standards*) (NCTM, 2000) have provided educators with a workable tripod having curriculum, teaching, and assessment for legs. According to the ideology, by adjusting the legs, every student can be offered a level field of support from which to learn mathematics. The standards document, as a trilogy, offers educators a tangible guide to adequately match the needs of all students with a meaningful mathematics education. And as with any equitable balancing act, finesse, and timing are critical.

Equity is an ideology. Disparities in achievement outcomes based upon race, sex, or national origin have long been key issues with regard to educational equity and have been the target of a large body of research. As the field of mathematics education strives to get its act together and to flourish amidst the public's demand for more definitive solutions, we must continually address diverse questions of equity. At different times and in different cultures, mathematics education has attempted to achieve a variety of different objectives. In its latest policy-guiding document, the NCTM has equity as its first guiding principle as a part of "making the vision of the *Principles and Standards* … a reality for all students" (NCTM, 2000, p. 12). Specifically mentioned in this equity principle are high expectations for all students (not just some), accommodating differences for students who may have special needs, and enabling and providing a significant allocation of human and material resources. A principal of mine once made the comment that the parents of our students do not send their worst children to school and keep their best ones at home—they send their only children to school to be our students. If we believe in success for all groups, then as standards become the basis for our mathematics curricula, they must set forth a truly democratic vision to promote equity. When these standards serve those who traditionally struggle to learn mathematics instead of only those for whom the standards are second nature, or a part of their *habitus*, then we are on the road to promoting real equity.

Unconscious Privilege

In 1990, Dr. Peggy McIntosh published an excerpt from a working paper for which she entitled *White Privilege: Unpacking the Invisible Knapsack*. In the article, she made an association with institutional strength, economic power, and white dominance by creating a list of 26 privileges, the style of which has been unabashedly duplicated by many others who also wish to put the dimension of privilege into discussion. McIntosh's analysis was instrumental in prompting discourse via distinguishing areas of actual privilege from other areas where people's rights were being trampled on. For the purposes of this theoretical framework, McIntosh's concept of unconscious privilege, privilege that persons have been subtly enculturated to be unaware of, will be used to lessen the obfuscation between those enjoying an unfair advantage and those suffering an unfair disadvantage with regard to the mathematics curriculum.

Summary of Theoretical Perspective

This research, which is both exploratory and theoretical in nature, uses the ideas of Gordon, Becker, Bourdieu, and McIntosh on capital, class, culture, *habitus*, and unconscious privilege to make sense of the ways in which some children arrive at the academic table better prepared to demonstrate scholastic success in mathematics than other children. Speaking very generally, Bourdieu's central point is that cultural practices obey the same rules as economic practices and are an integral element in the struggle for power and dominance and thus affect issues of equity. The term pedagogical capital, independently coined by both Gordon and myself as a subtype of cultural capital, was legitimized and is now being used to help direct future research to areas of potential unconscious privilege in the mathematics curriculum for one group over another which can give rise to inequity in mathematics education for disadvantaged students. When standards serve those who struggle to learn instead of only those who will learn, then we are on the road to promoting equity. Today, as schools are being called upon to prepare all children for success, the need has never been greater to produce insights that can assist all educators to create classrooms that provide all students with opportunities, not just the lucky few who happen to fall into a generous payoff field.

CHAPTER 2

LITERATURE REVIEW

Introduction

The following literature review outlines and summarizes some major research findings, theoretical frameworks, and other streams of thought related directly and indirectly to pedagogical capital, equitable access to scholastic success, and issues surrounding economically disadvantaged students. Analogously, it should help to position the reader to consider how closely current understandings of best practices are aligned with strategies necessary to produce scholastic success in students who lack a substantial amount of pedagogical capital. The hope is to enlarge the repertoire of explanations for why some students continue to find scholastic success in mathematics elusive. As is the case in any literature review, the author does not contend that the following is a complete summarization of all possible literature. Instead, the goal was that the reviews of the literature included served as a presentation in which to conduct this research.

Achievement Gaps

Eliminating achievement gaps and cultivating a culture of equitable scholastic success requires that mathematics teachers and mathematics policymakers continually examine policies, standards, and other structural elements of the mathematics curriculum that continue to perpetuate conditions which ultimately lead to underachievement among economically disadvantaged students. A holistic vision of scholastic success in mathematics for all students should ultimately acquire reformative strategies that are underscored by democracy, equity and a sense of justice that both confronts and addresses the root causes, and not merely the outward symptoms, that can be shown to generate these achievement gaps time and again. In his article, *Reforming, Again, Again, and Again*, Cuban (1990) explains that failed reform efforts are typically based on a lack of deep comprehension and vivid awareness of the actual problem(s) that are in need of address. He summarizes himself by saying, “The risks involved with a lack of understanding include pursuing problems with mismatched solutions, spending energies needlessly, and accumulating despair” (p. 11). He suggests that we carefully examine alternative explanations and to give serious thought to both rational and non-rational organizational behavior which might impede change due to being a dominant set of cultural repertoires. In the absence of meaningful, insightful, and genuinely robust discourse on the root causes that generate achievement gaps, successful, lasting reform is no more than mindless speculation.

In a similar vein, Johnson (2002) disputed the familiar notion that the reasons for underachievement lay solely in the hand of students and their families. In its place, he offered an alternative explanation, “the primary problem lies not in the way economically disadvantaged students and students of color view education but in the way they are taught” (Johnson, 2002, p. 6). Several studies have arrived at similar conclusions, that there are “less quantifiable, but at least as influential, hurdles that poor and minority students face in schools” (North Central Region Educational Lab, 2002, p. 9) (NCREL). These studies suggest that “these students experience a different environment in school and are treated differently than their white and affluent counterparts” (NCREL, 2002, p. 9). By utilizing both quantitative and qualitative measures to get valid information about the school culture, Johnson warns, “When policies and practices are analyzed, there is a very high probability that institutional biases and other uncomfortable issues may surface" (2002, p. 10). Nevertheless, it is through this process that the "potential for problem solving and improved practices related to student achievement" (Johnson, 2002, p. 10) can be effectively confronted and addressed—particularly as it relates to the issues surrounding policies, standards, and other structural elements of the mathematics curriculum that continue to perpetuate conditions which ultimately lead to underachievement among economically disadvantaged students. Affording equitable access to scholastic success in mathematics should not be an insurmountable principle, standard, or goal.

Critical Mathematics Research Using a Bourdieuian Analysis

Studies consistently show that the social and cultural backgrounds of a student are deeply influential in determining whether or not a student will perform well in mathematics. However, there has been less success in documenting the disadvantage in mathematics whereby the student's culture is different from the school's institutional culture. In a Bourdieuian analysis of language, social class, and underachievement in mathematics, Robyn Zevenbergen (2001) argues that some students arrive in the mathematics classroom predisposed to learn mathematics. This predisposition, however, is not due to some innate mathematical ability, but rather due to experiences, linguistic and otherwise, that the students first encountered in the family setting. "For such students, the language and styles of interacting with others which they are used to is similar to that of the formal mathematics classrooms, so they are better able to crack the code of the culture represented in these classrooms" (Zevenbergen, 2001, p. 47). Due to this cultural knowledge and linguistic experiences, students such as these are better able to position themselves favorably in the eyes of their teachers. And the converse is also true—those students for whom family experiences are different from the mathematics classroom find success in mathematics to be more evasive. The cultural capital of the middle-class child vs. the cultural capital of the working-class child was more likely to be traded successfully in the mathematics classroom, which in turn helped them to obtain educational qualifications that they could use in future trades. What this means is that for the disadvantaged child—or for any child for whom language is different from that which is used in the formal school setting—the chances of success in mathematics are reduced.

In a further Bourdieuian analysis by Zevenbergen (2002), streaming (or ability grouping) was objectified as a practice, which was internalized by students and which, thus, developed their sense of self, or their *habitus*. Using data from interviews with students in the compulsory years of secondary school, ages 14-16, student comments suggested that their internalized experiences of having been grouped in the mathematics classroom disempowered their ability to see long-term success for themselves. Zevenbergen concluded that this indicated a highly problematic relationship between the student and the mathematics classroom.

In another Bourdieuian analysis of the sociology of the mathematics classroom and its possible contribution to student failure, but more from the vantage point of power, Lerman and Tsatsaroni (1998) attribute student failure to structural elements such as pedagogical practices. The discourse of pedagogy—the text of pedagogy—is used as a starting point to investigate how mathematics classroom knowledge is different from everyday knowledge, how mathematics classroom interactions are different from everyday interactions, and what they call a recontextualization of the messaging system that needs to occur within the classroom. They contend that hegemonized cultural behaviors are dominant in schools and that these pedagogical mechanisms are responsible for reproducing social and educational inequality. They also contend that these same hegemonies prevail in the research community so that all mathematical text is tainted by the same brush as it is constructed, produced, distributed, acquired and then used for assessment. It was their hope that their research would open the door to further analysis of school assumptions and practices.

In a slightly different take on hegemonic school practices, Andrew Noyes (2002) applied his Bourdieuian framework to the school transfer that occurs between the primary and secondary school mathematics curriculum, where students often find themselves beginning with a clean slate and a new “learning landscape” (p. 5). Noyes addresses the culture shock that accompanies this school transfer as children face not only new teachers and surroundings, but also changes in the very nature of school. He discussed how students lost much of their primary school momentum in the learning of mathematics due to the fact that the secondary school operated under and with a different style of *habitus* and field. Indeed the two levels of schooling had different social rules and structures. He unpacked the imagery of the “learning landscape” (Noyes, 2002, p. 5), and in this dimension, the analogy parallels Bourdieu’s notion of *habitus* and field.

In an exploratory study, Cooper (1998) suggested that children’s difficulties with realistic mathematics test items were due to a discrimination against working-class testees. When an acultural child, meaning a child from a different culture, imports their everyday knowledge in an inappropriate or illegitimate way, typical assessments strategies tend to underestimate the mathematical capacity of that child. Leaning heavily on Bourdieu’s work on the social role of culture in the development of judgment and taste, certain cultural validation factors relations begin to come into play. There begins to be a substantial usefulness for Bourdieu’s ideas with regard to fairness in testing. Since *habitus* is rooted in an individual’s socioeconomic and cultural experience, when test items embed mathematics in a realistic context, there might be an unfairness with respect to cultural background.

In one final Bourdieuian analysis, Boaler (2002) considers mathematical dispositions and practices that students bring to bear when engaging in problems, which once again, have their foundations in inculcated practices and acts as a mathematical *habitus*. Conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and productive disposition are all skills that require incremental staging and scaffolding. These Bourdieuian practices reference “specific things that successful mathematics learners and users *do*” (Boaler, 2002, p. 16). Engagement in mathematical practice is both a stage and an object, which unfolds in multidimensional complexity. If there is to be a mathematical *habitus*, then there needs to be research that is generative in helping researchers, mathematics teachers, and mathematics policymakers understand how students develop.

Critical Research on Family/Group Practices

While controversies still abound in educational research, the trend has been toward pinpointing specific resources that really matter for children’s achievement. In *Home Advantage: Social Class and Parental Intervention in Elementary Education* (*Home Advantage*) by Annette Lareau (2000), the daily workings of social class and how social class affects a parents’ ability to pass along advantages to their children are presented in vivid detail. Lareau compares and contrasts what Bourdieu’s notion of cultural capital means in the current American setting as middle-class and working-class parents direct their time and energy toward their children’s scholastic success. In this book, Lareau challenges “the position that social class is of only modest and indirect significance in shaping children’s lives in schools” (Lareau, 2000, p. 2). She argues that social class, as a variable independent from ability, not only can but also does affect schooling.

According to Lareau, “in every society, parents with cultural capital will try to transmit their advantages to their children, but the way in which they do so is likely to vary with the organizational form of schooling and with the types of performance and knowledge that are mostly highly valued” (Lareau, 2000, p. xiv). She explored the ways that parents who are a part of the middle-class culture draw upon resources that are specific to them, particularly concerning their knowledge of the inner workings of schools, as they help their children. Middle-class parents set out to help their children—they are very aware that the child’s future success depends upon how well they do in school. They do not set out to conspicuously display class privilege. However, in the myriad ways that they help their children by investing their cultural capital, they inadvertently increase inequality. One of her overriding observations is the contrast in how the spheres of home and school are viewed by the two classes. Working-class parents viewed home and school as separate spheres of influence, while their middle-class counterparts saw them as closely intertwined (Lareau, 2000).

When these parent-wrought advantages are compared through a careful investigation of teachers’ perceived standards and preconceived attitudes, it is the parent of the middle-class child who has systematically inculcated the child with the mastery of a robust variety of academic skills and attitudes which are the end product of many incremental steps (Lareau, 2000). Or as Bourdieu would surmise, the parental unit(s), working in conjunction with the family field, has the time from birth onward to direct the flow of the student’s *habitus*. As previously mentioned, inculcation and assimilation take time—time that must be invested personally. Like the acquisition of a suntan or of a swimmer’s stamina, it cannot be done second-hand. This rules out many of the effects of the school and community because delegation is thus impossible (Bourdieu, 1986, 1998). Therefore, the majority of the yield in the form of scholastic success for a given child depends on the cultural capital in possession of the family and on the amount of that capital which is invested by that family. Eventual educational quality ends up being a relation between the inertial qualities of the family's accumulated capitals and those activities that occur in the school.

Another excellent example of family and group practices is Lareau's *Unequal Childhoods: Class, Race and Family Life* (*Unequal Childhoods*) published in 2003. This book contains groundbreaking research into families who are rearing children by one of two strategies, one Lareau calls concerted cultivation and the other she calls the accomplishment of natural growth (Lareau, 2003). Again, leaning heavily on the cultural capital theory of Bourdieu, Lareau is able to capture the texture, describe the quality, and to give a peek at the quantity of the inequality experienced by some children. It would be an easy leap to say that in the current institutional scenario of schooling, children who are being reared using the strategy of concerted cultivation possess pedagogical capital in both Gordon's and my notion of the term and those who are being reared using the strategy of the accomplishment of natural growth do not possess the same qualitative or quantitative amount of pedagogical capital. In a similar separation as in *Home Advantage*, Lareau documents that working-class and poor parents viewed the world of the parent and the child as separate spheres of influence, while their middle-class counterparts saw them as closely intertwined

In *Unequal Childhoods*, Lareau (2003) argues that key elements of family life cohere to form a cultural logic of child rearing. Again, the disjointedness of the two styles of child-rearing separates the middle-class child from their working-class or poor peer. Middle class parents tend to adopt the strategy she calls concerted cultivation and working-class and poor parents, by contrast, tend to undertake the accomplishment of natural growth. "For working-class and poor families, the cultural logic of child rearing at home is out of synch with the standards of the institution" (Lareau, 2003, p. 3). Once again, it is the continual inculcation of the child by the middle-class parent that brings about in that child a practical mastery of the ways of the school; concerted cultivation fosters an academically friendly *habitus* and a *docta ignorantia* (Bourdieu, 1980, p. 102) that seems to act as a lubricant in the machinery of education while the accomplishment of natural growth acts more as a wrench in the workings.

While both concerted cultivation and the accomplishment of natural growth offer certain advantages/disadvantages as far as family relations are concerned, it is important to note that they are accorded different social values by some highly important and influential social institutions in the lives of the parent and the child. The middle-class strategy, concerted cultivation, appears to offer a greater promise of being transubstantiated into social, educational, and then later financial profits than does the working-class and poor strategy of the accomplishment of natural growth (Lareau, 2003). The is probably because the *habitus* developed within the middle-class child over the years is more closely aligned with the dominant set of cultural repertoires and behaviors that comprise the standards and policies of institutions like the school and the work environment. A close look at the social class differences mirrored in the standards of these institutions can provide an opening for some vocabulary for understanding inequity—particularly if those institutional standards give some cultural practices a nod over others in that they pay off in settings outside of the home. The cultural indicators in the instances of these two pieces of research are mostly closely summarized by a lack of separation between the spheres of the home and the school, and the spheres of the parent and the child, which in turn mirrors the expectations of the teacher and school.

Critical Mathematics Research on Parental Involvement

Pedagogical capital and concerted cultivation involves an investment of time made by the parental unit(s). Fortunately, there is a wealth of research on parental involvement in the education of children. Much of this focuses on help with homework or being a pedagogical guide for the student as they navigate the shoals of the institution and the curriculum. The perception that parental involvement has a positive effect on student's scholastic success is so intuitively appealing that policy makers (Wagner & Sconyers, 1996), school board administrators (Roach, 1994), teachers (Allen, 1996), parents (Lawler-Prince, Grymes, Boals & Bonds, 1994) and even students themselves (Brian, 1994), have agreed that parental involvement is critical for children's scholastic success. As a result, there has accumulated what appears to be a massive body of literature about parental involvement. Although the appeal of parental involvement as part of a remedy for school education has been very strong in society as a whole, there remain some sticky issues related to research on parental involvement, because the research findings in this area have been somewhat inconsistent. Generally speaking, although some empirical studies have shown evidence of a positive effect of parental involvement on scholastic success (Singh *et al*., 1995), others have found little, if any, such measurable effect (Bobbett, 1995).

Research in the area of parental involvement, however, has been somewhat fragmented for quite some time and very little of it involves parental involvement in mathematics learning. Despite it intuitive meaning, the operational use of the term parental involvement has not been clear and consistent. Parental involvement has been defined in practice as representing many different parental behaviors and parenting practices. Such practices as parental aspirations and the conveyance of such aspiration, parents communication with children about school, parent participation in school activities, parent communication with teachers and parental rules imposed at home are all considered to be educationally related (Fan & Chen, 2001). This somewhat chaotic state in the definition of the main construct not only makes it difficult to draw any general conclusions across the studies, but it may also have contributed to the inconsistent findings in this area.

Because parental involvement subsumes a wide variety of parental behavior patterns and parenting practices, it is probably better to conceptualize this construct as being multifaceted in nature, and therefore the use of the term pedagogical capital creates a workable theoretical framework (Gordon, 2001). To be able to say a child is in possession of or has pedagogical capital or not and to ponder the implications of that possession has many practical applications. Although there is evidence that certain dimensions of parental activity or involvement may have a more noticeable institutional effect than some other dimensions of students' scholastic success (Lareau, 2003, Singh *et al*., 1995), the direct result of these multifaceted dimensions is an inconsistency in the literature. What seems to be lacking is empirical research that has been conducted with the benefit of a guiding theoretical framework, which the use of the term pedagogical capital and Bourdieu's notion that scholastic achievement is related to access to and participation in logical practices with systematic supports, that form various types of capital, can provide.

In a meta-analysis of 25 empirical studies on parental involvement spanning a ten-year period, Fan and Chen (2001) found through moderator analysis that parental aspirations/expectations for children's scholastic achievement had the strongest relationship with scholastic achievement, whereas parental home supervision had the weakest relationship with scholastic achievement. They surmised that parental supervision might more likely occur when the child is already struggling in school and thereby have a negative bias toward the global indicator of scholastic achievement. Lareau found that struggling students received a higher level of direct parental involvement (Lareau, 2000). Fan and Chen found that global indicators such as overall grade point average showed a much stronger relationship than did subject specific indicators such as a math grade or reading test score. Global indicators may be a better indicator for students' overall academic achievement than those that focus on a specific academic subject. Since any unreliability between variables has a tendency to attenuate or nullify the correlation coefficient between two different variables like a math grade versus a reading grade, a composite score like an overall grade point average is generally more reliable in an analysis than one of its subcomponents, again for instance the math or reading grade (Hunter & Schmidt, 1990). The authors (Fan & Chen, 2001) suggested further empirical research, which should include studies of class variation, perhaps like that of Lareau's differing parenting styles since she was able to show that the parenting style had as its basis socio-economic class.

While it is generally accepted that parental involvement has a desirable effect on student achievement, there is little agreement on how it is best implemented or at what point in the curriculum it can be best introduced. The kinds of activities in which parents are likely to engage—and engage in successfully—change as a student progresses through school. Muller found in 1998 study on gender differences among 8th, 10th and 12th graders that the relationship between parental involvement and achievement is similar for girls and boys but that it diminishes over time to the point that parental involvement has essentially no relationship in the gains made by seniors (Muller, 1998). Children are probably open to different kinds of relationships with their parents, depending on their developmental age, with older adolescents demanding and getting more autonomy from their parents. Thus, it seems likely that parental involvement before grade eight may mitigate some aspects of the earlier processes making such involvement meaningful and effective in fostering scholastic success. For that reason, this research looked at some parental involvement that occurs in elementary age students, and in particular, fostering scholastic success in mathematics.

Research suggests that parents can help most effectively in providing home reinforcement of school learning by supplementing school work at home, monitoring and encouraging their children's learning (Gordon, Bridgall, & Meroe, 2005; Yap, 1994). However, a study identified the least popular parental involvement activities to be monitoring homework, providing input on homework and stimulating discussion at home, some of the very methods in Lareau's definition of concerted cultivation. Much more popular were parent committees, parent-teacher meetings and workshops on parental involvement (Griswald, Cotton & Hansen, 1986). It would be safe to say that students who have more of these out of school supports—and perhaps more of the least popular parental activities—possess more pedagogical capital than students who have less.

In a study intended to identify specific parental involvement practices that contribute to positive outcomes for Chapter I projects in elementary schools, Yap (1994) found that few significant relationships appeared to exist between parent involvement activities and the children's school performance. Where the link was found, it generally relates to home-based reinforcement provided by the parents. The author concluded by suggesting that more resources should be devoted to the development and promotion of home-based reinforcement activities and that to do so would further enhance parent involvement. But if at-home reinforcement is an unpopular activity (Griswald, Cotton & Hansen, 1986), there is a chance that the curriculum will be enhanced in a way that privileges those with pedagogical capital over those who lack pedagogical capital.

Reform Literature on Parental Involvement

The NCTM's seminal publication, *Principles and Standards* (2000), is a response similar to the responses that occurred with regard to the Coleman Report. It doggedly focuses on the curriculum in a way that excludes experiences outside of the classroom. This document is specifically designed to orient curriculum, teaching and assessment efforts. It does not seem to have been designed to combat Lareau's unequal childhoods or to address those students with below average pedagogical capital or those who do not have a decided home advantage.

Principles and Standards was intended to be a resource and a guide for decision-makers that affect mathematics education. Its intended audience is professional in nature and it only addresses families and parents in an offbeat way (Peressini, 1998). A hallmark of the publication is how many professional mathematics organizations were able to serve together reflectively and in a consensus-building manner to create a document that serves those who are interested in mathematics education. *Principles and Standards* reflects the input and the influence of many different sources. According to the authors, "educational research serves as the basis for many of the proposals and claims made throughout this document about what is possible for students to learn about certain content areas at certain levels" (NCTM, 2000, p. xii). The content and processes emphasized are based upon "past practice in mathematics education, and the values and expectations held by teachers, mathematics educators, mathematicians, and the general public" (NCTM, 2000, p. xii). By its own pen, *Principles and Standards* is a document intended to set goals, to serve as a resource, to guide in the development of curriculum frameworks, and to act as a gadfly to stimulate conversation about how best to provide a deep understanding of mathematics (NCTM, 2000).

The document is organized into four main parts. The first part explains the NCTM's five principles for school mathematics. These principles include equity for all, a coherent curriculum, effective teaching, learning with understanding, supportive assessment, and influential technology. The second part gives an overview of the ten standards that are repeated for all of the grade bands and which include number and operations, algebra, geometry, measurement, data analysis and probability, problem solving, reasoning and proof, communication, connections and representation. The third part outlines specific grade-level content goals for each of the grade bands, for example, additive reasoning in K-2, multiplicative and equivalent reasoning in 3-5, algebraic and proportional reasoning in 6-8, and then more sophisticated reasoning in 9-12. The fourth part contains a discussion of some steps that should be followed to fully embody their vision (NCTM, 2000).

To fully understand the curriculum galvanizing effect of *Principles and Standards*, one must look at the focus that is promoted in the idea of "moving on" (NCTM, 2000, p. 7). According to the document authors, school mathematics programs should not be repetitive nor should every topic be addressed each year. "Instead, students will reach certain levels of conceptual understanding and procedural fluency by certain points in the curriculum" (NCTM, 2000, p. 7). "It is not expected that every topic will be addressed every year. Rather, students will reach certain … levels of fluency with the procedures by prescribed points in the curriculum, so further instruction can assume and build on this understanding and fluency" (NCTM, 2000, p. 30). The authors clearly intend that teachers should be able to assume known levels of fluency when they plan their mathematics lessons. While educational equity is a core element of this vision, an unintended and unfortunate consequence might occur when students who do not possess the pedagogical capital of those for whom this vision is encounter the curriculum recommended by this document. Or in other words, *Principles and Standards* might form a dominant set of cultural repertoires that privileges the middle-class child rearing strategy at the expense of poor or working-class child rearing strategies.

For instance, one prescribed point requires a fluency in multiplication pairs by grade 4 during the grade band 3-5, when the student is assumed to be developing multiplicative reasoning. According to the authors, multiplicative reasoning is an important topic for understanding the proportional reasoning expected in grade band 6-8 (NCTM, 2000). However, factual knowledge and efficient recall of the common multiplication pairs is not an easy feat if one does not have pedagogical capital—supports for educational activities outside of the school. The authors state, by "the end of this grade band, students should be computing fluently with whole numbers. Computational fluency refers to having efficient and accurate methods for computing" (NCTM, 2000, p. 152). The vision goes on to proclaim that, if "by the end of fourth grade, students are not able to use multiplication and division strategies efficiently, then they must either develop strategies so that they are fluent with these combinations or memorize the remaining 'harder' combinations" (NCTM, 2000, p. 153). The *Alabama Course of Study: Mathematics* addresses multiplication pairs also. Second grade students are expected to be able to interpret multiplication as repeated addition. In 3rd grade, students should be able to apply basic multiplication facts through 9x9, or all of the single digit pairs. And by 4th grade, students should have fluently master the fact families through 12x12 (Alabama Department of Education, 2003). If this happens for all students was a question that this research began to look at, along with if those students who possess more pedagogical capital gain a privilege or an institutional advantage by the prescribed curricula.

That the notion that pedagogical capital or other parental involvement is missing from *Principles and Standards* is not unusual for a reform document. Using various reform recommendations, Peressini (1998) found that most of the documents concerning school mathematics calling for parental involvement position parents on the periphery of the mathematics agenda. The author surmised that there was a historical element to this positioning. For instance, the New Math reform era of the 1960's, ushered in by the Sputnik fiasco, did not include parents in that effort. As a matter of fact, there was a huge backlash in that parents suddenly found that they could not help their children with the math content of this 1960's New Math reform. A real failure to educate the public about the goals and content was a leading factor in the demise of the New Math era, a demise that was perhaps brought about by parents who made it a point to deliberately infringe upon the expertise and professionalism of educators. And in 1977, the Mathematical Association of America and the NCTM "issued a joint statement on college preparatory mathematics which, while acknowledging positive changes during the 1960's, embodied an unmistakable renunciation of the most daring reform ideas and an urging to emphasize more traditional instructional goals and methods" (Fey, 1978, p. 339). According to Peressini, many of the reform efforts of the 1970's centered around the need to eliminate the conflict that was occurring between parents and educators. Or in other words, even in the 1970's, mathematics reform programs really only included parents by reacting to their dissatisfaction with the math programs of the 1960's. When the 1980's began, educators began renewed efforts to professionalize their practice. There seemed to be a shift from ignoring parents to recognizing the power that parents can exercise over the curriculum (Peressini, 1998).

The reform literature since the 1980’s recognizes the importance of keeping parents and the general public informed by actively raising public support at the same time that reform efforts are underway.

There is a noticeable absence of any extended discussion about the roles of parents even in the newest *Principles and Standards* (NCTM, 2000). Prior to their 2000 introduction, Peressini found in his work that the duties proscribed to parents in most reform literature of the era were to instill the proper beliefs about the importance of mathematics, to become informed about standards in mathematics, and to ensure that school budgets were sufficiently large to meet the need of the reform efforts (Peressini, 1998). The *Principles and Standards* of 2000 prescribe a similar parental role by envisioning families that “signal that they believe mathematics is important” (NCTM, 2000, p. 378). According to the NCTM, parents can help reform efforts by establishing a learning environment at home that enhances the work initiated at school, providing a quiet place to read and do homework, and by monitoring student work. No where is any address made to who might help a third or fourth grade child with numerical fluency outside of school or that some children come to school better equipped to benefit from the school experience due to pedagogical capital or parental involvement. But the fact remains, like the differing sections of my rock wall, the hand- and footholds that a student finds as they attempt to climb their mathematical and scholastic wall can be vastly different from child to child. To have pedagogical capital is to have closely spaced supports—perhaps even more than is necessary for the task. To lack pedagogical capital is to climb a wall with very few supports—perhaps with supports that are not adequate to the task.

Summary

The future of American education lies in a commitment to a democratic promise of equitable scholastic success for all students, regardless of social standing, family background or household portraiture. This chapter gave an overview of literature related to some major research findings, theoretical frameworks, and other streams of thought related directly and indirectly to pedagogical capital, equitable access to scholastic success in mathematics, and issues surrounding economically disadvantaged students. Analogously, it should have helped to position the reader to thoughtfully ponder how closely current understandings of best practices are aligned with strategies that are necessary to produce scholastic success in students who lack a substantial amount of pedagogical capital. The hope was to enlarge the repertoire of explanations for why some students continue to find scholastic success in mathematics elusive. For this literature review, rather than adopting the position that past research, standards, and policy have never addressed the root causes of students' failure to thrive mathematically, I will end with a quote from Thomas Alva Edison, and suggest that through the following research we give careful consideration to the alternative explanation that the privilege of pedagogical capital, as an unconscious privilege and as a framework for understanding scholastic success in mathematics, can offer.

"I have not failed. I've just found 10,000 ways that do not work."

CHAPTER 3

METHODOLOGY

Introduction

In this chapter, the rationale for the design of this research, the methodology used, and procedures followed are presented and discussed. With the purpose of examining the organization of a mathematics concept presented in two disparate schools in great detail and in sufficient depth, a case study approach was selected as the research paradigm so that intensive understanding could emerge through quantitative and qualitative inquiry.

Case study definitions vary and can range from very formal statements to rather simplistic assertions. Lincoln and Guba (1985) offer a very formal definition of a case study as an "intensive or complete examination of a facet, an issue, or perhaps the events of a geographic setting over time" (p. 360). In a more simplistic assertion, they describe case studies as "a slice of life" that has a "depth (of) examination of an instance" (Lincoln & Guba, 1985, p. 360). On the other hand, Yin (2002) defines a case study as a research strategy that investigates a phenomemon through empirical inquiry within its real-life context. It relies on multiple sources of evidence and benefits greatly from a well-defined theoretical perspective. Yin points out that case studies can be based on a mix of quantitative and qualitative evidence. A case study can be written for a variety of purposes, including to paint a picture of the structure of the social world at any given moment, which best portrays the rationale for its use in this research.

The qualitative methodology to be employed in this research, Classic Grounded Theory (CGT), is an approach that draws on the idea that theories should emerge as the data is collected rather than being forced from it after the data collection is over. As with case study, CGT operates as a reference point and can function as the anchor founding a theory or a school of thought since both utilize empirical data within a real-life context to generate theory. It has the goal of generating both inductive and deductive concepts and can explain actions regardless of time and place, thus making it a valuable vehicle for mixed-methods research. With CGT, as data are collected, key points are marked with a series of codes which may be as simple as what happened or why something happened. Codes of similar content are then used to group the data into a series of concepts, which are used to create categories which ultimately allow for a collection of explanations that generate and explain the theory (Glaser, 1992).

To anchor these two qualitative research approaches to my theoretical perspective, that pedagogical capital is a subtype of cultural capital which may offer an unconscious privilege for one group over another, consider that the concept of pedagogical capital will be a newly generated theory that can possibly direct future research as has happened with other new theories in the past. For instance, in their 1964 book (which was at last translated into English in 1979), *The Inheritors: French Students and Their Relation to Culture*, Bourdieu and Passeron (1979) offered a rigorous analysis of the French educational system. They presented a theory for understanding some enduring social relations with regard to pedagogical practices. They contended that any inheritance of pedagogical significance was social in origin. They further contended that the mechanisms through which cultural capital was inherited and re-produced were suggested as they emerged through examples of comments made and interviews conducted that highlighted empirically grounded discursive and social practices (Bourdieu & Passeron, 1979), some of the very methods of case study and CGT.

The quantitative methodology to be employed in this study is standard hypothesis testing using inferential statistics as contained in the Statistical Package for the Social Sciences (SPSS) where the concepts involved in probability, sampling, and estimation about the difference between two means can be implemented using independent two-sample *t*-tests. American educational research has tended to neglect this issue of the relationship between educational standards, the day-to-day outcomes of life in the classroom, and social re-production. Due to the theoretical perspective of the researcher (which involves connecting sociological ideology to grounded empirical research in the style of Bourdieu) and the purpose of this research (that the term pedagogical capital enter the lexicon of educational research), the foundational theory and methods of CGT, along with the inferential statistical testing made possible by using the SPSS program, made them particularly well-suited as vehicles of analysis for this research.

Autobiography

I entered into a Bourdieuian field of scholastic play as a working-class, white girl. My mother was a high school graduate, but my father had dropped out of high school and passed the General Educational Development Test (GED) after being drafted into the army in 1956. They married soon after his enlistment was over, on her 19^{th} birthday. I was born before the first year of their marriage had passed. There is a history of mental illness in my mother's family—her mother spent the last 35 years of her life institutionalized—and my mother has less serious, but still noticeable problems, of which include rarely speaking for long periods of time, so there was little verbal interaction between parent and child when I was growing up. When I was very young, I rarely got a store-bought dress or play clothes. Mine came to me as hand-me-downs from women my mother worked with and perhaps from the Goodwill because my mother shopped there on a regular basis—or my mother would sew my clothes. While my parents owned the house we lived in when I was in elementary school, and while our street had newer homes, it was surrounded by a declining neighborhood with unpaved streets. We moved into a more affluent community during the summer following my 5^{th}grade year. By that time, my father had graduated from college and was employed again.

Based upon my childhood activities, I can rather confidently say that I was reared using Lareau's strategy of the accomplishment of natural growth and not with the more desirable strategy of concerted cultivation. There was both a clear divide between my childish world and that of the adults in my life, and a divide between my home and school. I never attended a kindergarten, so my first day of first grade was the first time I had ever been inside of a school—or had even eaten in a cafeteria. I could "read" before I started first grade, but what I remember was that I could memorize the words to a children's book and recite them back on the correct pages, since children's books have very few words and they have pictures that act as cues. I remember learning to decipher words in first grade and becoming fascinated with reading. However, there were few children's books in my house unless we borrowed them from the local public library, so most of the reading I was able to do occurred at school—and I loved reading. When I was in first grade, my father made a decision to stop working as a welder to attend college the following fall using his *GI Bill of Rights* benefits before they expired. My mother worked as a bank teller to support the family of two adults and three growing children. Both my first and second grade teachers were older women who had pianos in their classrooms. They would play whilst we sang—I learned to read the words to songs that way. In third grade, I had a new, young teacher who drilled us on addition and subtraction facts using flashcards. I was enthralled by her flashcards. However, there were no flashcards in my household at the time, so I made my own on scraps of paper and played "school" while my dolls, Kissy, Mrs. Beasley, and an unnamed koala bear, sat behind cardboard box desks in the bedroom I shared with my sister. A man down the street had stopped being a salesman about this time, and one day I pragmatically salvaged quite an assortment of order pads that had carbon paper from his trash and brought this treasure home to play "school" with for many months afterward. In 4^{th}grade, I was introduced to the multiplication pairs. I stood amazed the next day as my fellow students could recite the answers—when I was still struggling to know them additively. I went home and drilled my dolls on multiplication pairs that night and for many weeks afterward.

It was then that I discovered that some children had help at home that I did not have. Prior to this, I thought all kids had families just like mine and that school was a child's job. Since there was such a clear divide between adult and child, and school and home for me, I couldn't quite get over the notion that involving parents in schoolwork was somehow cheating. I struggled for the next few years to gain fluency in the multiplication pairs, and struggled also with other math concepts that were being introduced to me during that period, for instance division and fractions. I could do the work, but it took me much longer than my seemingly gifted peers to master the tasks. I was still doing much of my multiplication additively—I did not have a fluency in the multiplication pairs—and I was not working in concert with a pedagogical guide in my home. Of course, that was in the days prior to the introduction of the low-cost hand calculator, so in order to produce correct answers, I had to master the concept of the mathematics by hand, which seemed to nurture an appreciation for the underlying patterns that the language of mathematics was being used to describe. I began to love math.

But outside of school, and like the poor and working-class children in Lareau's study on the accomplishment of natural growth and in my study, I spent most of my time just playing games with other children or playing alone. It was not until the end of 7th grade, when some of my most gifted classmates were inducted into the Junior High Honor Society, and I was not, that I began to take any of my schooling seriously. I began to do school work outside of school. By the end of 8th grade, I had become an honor student also. Truly, I was completely unaware that some children had developed a scholarly *habitus* early in life. Despite the fact that my father had completed his college degree by the end of my elementary years, college for me was never discussed in my house even during high school. At that time, I was well on my way to re-producing the low-level labor-power that my mother was involved in.

By the time I finished high school, a rather traumatic divorce between my parents, and the discovery of the availability of grants and scholarships for college had changed my trajectory. Later on, as a parent, I seemed have taken a page from Herbert Kohl's 1994 book, *I Won't Learn from You.* I was determined that my own children would not struggle in the institution of school as I had. Thus, I adopted the child-rearing strategy of concerted cultivation, without knowing that it was typical to my newly established middle-class status as a schoolteacher, and I began to systematically pass on my cultural capital to my children by providing them with a very high level of pedagogical capital.

Purpose of the Study

Alabama has a long history of displaying underachievement in mathematics among its economically disadvantaged students and success in mathematics for its more affluent students. The purpose of this study was to identify factors and/or resources that facilitate or impede scholastic success in mathematics especially for the economically disadvantaged student.

Additionally, this study was designed to reveal relationship(s) among those factors and/or resources. However, in order to truly provide all children, regardless of class, with an equal life chance, mathematics teachers and mathematics policymakers must confront and address some very difficult issues ingrained within the mathematics curriculum that adversely affect the performance of economically disadvantaged students, particularly if demographic trends point to the continued growth of that population. Amid the current rhetoric surrounding the rationale that no child is to be left behind, the school culture and any structural elements that might perpetuate the inequities of educational opportunity for students who are economically disadvantaged can no longer go unnoticed, nor can they continue to be politely dismissed.

Introduction of Research Questions

Central to understanding the phenomenon of success or failure, the term pedagogical capital was advanced as a subtype of cultural capital and as an unconscious privilege granted to one group. It was also used as a framework for understanding some logical practices and systematic supports that lead to scholastic success in mathematics. A theoretical underpinning of this research was Bourdieu's idea that in order to be used successfully as a source of power, or to direct researchers attention to areas of unconscious privilege for one group over another, the subtypes of cultural capital are in need of being identified and legitimized.

To do so, three types of questions were researched. The first was a quantitative question which resulted in deductive conclusions. The second was a qualitative question which resulted in inductive conclusions. The third question addressed social justice. Referring back to my analogy of climbing the rock wall, as school children attempt to climb their scholastic wall, it was important to consider whether the hand- and footholds available to them were judicially placed or if it was even possible to place them so.

Questions

The following questions guided this empirical and qualitative research:

4. Is there any empirical evidence that would show that the mathematics curriculum has areas of privilege for those with pedagogical capital over those without it; for instance, are there any elements in the *Alabama Course of Study: Mathematics* where children in possession of pedagogical capital thrive while their peers who do not possess adequate pedagogical capital struggle to or fail to demonstrate scholastic success in mathematics?
5. Can the term pedagogical capital, as an unconscious privilege possessed by some students and as an ideology in its own right, which is being advanced for general vocabulary usage, offer a compelling qualitative interpretation for some scholastic success in mathematics?
6. Would this privilege be in keeping with the equity principle as outlined by the National Council of Teachers of Mathematics in their *Principles and Standards for School Mathematics*?

Design of Study

For my methodology, I attempted to answer Annette Lareau's "so what" question. Using both quantitative and qualitative analysis, I hoped to show that my interpretation of using the notion that pedagogical capital may offer an unconscious privilege for one group over another offers a more compelling way of looking at this issue than other interpretations have been able to offer to date. Rather than focusing on math achievement in general, I looked at how one line-item in the curriculum can produce unequal learning situations depending upon whether a child has the privilege of pedagogical capital or not. This was an ethnographic case study of 3rd grade students being introduced to the general properties of multiplication pairs with the implied curricular goal that they develop fluency in the single digit pairs by the end of the school year.

It involved fieldwork in four 3rd grade classrooms, interviews with students, teachers and parents, and a series of achievement-type quizzes to assess whether or not children were at or above grade level on multiplication pair fluency by the stated goal. Using Bourdieu's notion of pedagogical capital being a subtype of cultural capital, the results should highlight that students who possess pedagogical capital (supports for education outside of the school) entered into this field of multiplication pair play with a higher probability of becoming scholastically successful with the prescribed task.

Two elementary schools in the immediate area were selected. Information-oriented sampling was used to select the schools, as opposed to random sampling. One school was considered to have a lot of pedagogical capital and the other had not much. Schools at the ends of the socio-economic spectrum were selected because average or typical cases are often not always the richest in information. By strategically selecting the cases to be studied at the extremes, results can be expected to be valid for all or for a large number of cases across the range (Flyvbjerg, 2006). Furthermore, I wanted two disparate schools within the same area so factors like local community, selected textbooks, district supplied resources, and local administrative philosophy would not be as much of a variable in the study. Both of the schools were predominantly white, because I was more interested in the socio-economic class implication and less with race and/or gender. As Lareau (2003) points out in her book *Unequal Childhoods*, up until at least the 4th grade, social class seems to matter more than race or gender in determining a child's probability of success in school.

The overwhelming difference between these two schools was in their poverty, non-poverty population makeup and their math sub-test percentile rankings on yearly standardized tests. One school, which I labeled A LOT, had an average 28% poverty rate over the past five years and a math sub-test percentile ranking of 75, while the other, labeled NOT MUCH, had an average 53% poverty rate and a math sub-test percentile ranking of 36. Poverty figures were based upon the number of students reported having free lunch. Another interesting statistic is that at A LOT, there is an extremely active parent body, or in other words, there is a significantly large amount of pedagogical capital being invested by the parents at this school that may not be mirrored at NOT MUCH. To show the economic disparity between the two schools, there will be some discussion of the major fund raising project undertaken by the parents at each school during the school year under study.

As shown in Table 3, 3rd grade mathematics sub-test percentile rankings for the 10th edition of the Stanford Achievement Test (SAT-10) reported for the years 2002 forward shows that the students at A LOT consistently score higher than their peers at NOT MUCH. Interestingly, this gap widens in the 4th grade. Also shown in the table are poverty vs. non-poverty student population data.

Table 3

Alabama Department of Education School Data, 3rd Grade[a]

Indicator	A LOT	NOT MUCH
2002-2003 math sub-test percentile ranking	72	37
2003-2004 math sub-test percentile ranking	71	40
2004-2005 math sub-test percentile ranking	75	37
2005-2006 math sub-test percentile ranking	79	32
2006-2007 math sub-test percentile ranking	80	37
2002-2003 non-poverty	70.3%	50.8%
2003-2004 non-poverty	72.6%	51.7%
2004-2005 non-poverty	77.6%	43.3%
2005-2006 non-poverty	68.8%	45.0%
2006-2007 non-poverty	69.6%	42.0%
2002-2003 poverty	29.7%	49.2%
2003-2004 poverty	27.4%	48.3%
2004-2005 poverty	22.4%	56.7%
2005-2006 poverty	31.2%	55.0%
2006-2007 poverty	30.4%	58.0%

[a]summarized from state department school reports

Upon given advice, I did field work within the schools at the beginning of the school year so that I could get some background information for the study. There are four 3rd grade classes at each school, but two teachers at each school were selected by virtue of being the only teachers to volunteer to be in the study. The four teachers were interviewed as to their perspectives and any preconceived ideas about their student populations. During the course of the study, and while the timed multiplication quizzes were being given, the four teachers were informally interviewed on a bi-weekly basis concerning the previous two weeks and field notes were recorded. The classes were visited once every two weeks. Careful field notes were taken as to how and when the introduction of multiplication was to occur in order to document if there were any discrepancies between when the topic was introduced and how the lessons were taught at the two schools that might be significant to the emerging theory. Students were assessed every two weeks for fluency in multiplication pairs using the quizzes found in Appendix C beginning at the start of the school year and continuing to the end of the school year. Students were allowed 7 minutes to write as many answers as possible. These were assessed and the scores documented so that any statistically generated significances between the two schools would be apparent each week as the research progressed using independent two-sample *t*-tests. If there were significant differences, they were noted in the research journal, and then data analysis and field notes were consulted in order to identify anchors and themes as they emerged. They were also used to continually develop the working hypothesis.

Classic Grounded Theory

Obviously, all research must be "grounded" in data, but few studies produce new theory or conceptual understanding in the way that Bourdieu was able to. Classic Grounded Theory is a methodology that is inductive in nature. It doesn't "prove" anything directly, but through theory grounded upon data it offers the tightest argument to date. It systematically generates theory from empirical research in the style that Bourdieu created his notion of *habitus* based upon the ability of the Kabyle to re-create their social structures or his notion that cultural capital was the inherited mechanism that re-produced the enduring discursive and social practices in the French educational system (Bourdieu & Passeron, 1979).

Bourdieu considered "the domestic transmission of cultural capital" (Bourdieu, 1986, p. 244) to be the best hidden and possibly socially most important educational investment that can be made in a child. After independently coining the same term for the same phenomenological quality, Gordon and I both agreed that the achievement gap between those with and without pedagogical capital "… may be the only achievement gap that really matters" (Livingston, 2005). However, for the CGT portion of this research, it seemed too simplistic to consider that one group would have pedagogical capital and the other would have none. For this research, one category would be having a lot of pedagogical capital and the other would be having not much. According to Bourdieu, we enter a field of play at birth much like a not too subtly hidden Markovian chain with a payoff matrix. Such idealized matrixes can capture much of the statistical regularity of a field of play even without describing the full structure of the field perfectly. These idealized matrixes allow for effective pattern recognition, and can even create path-dependent arguments, where current cultural capital configurations are suspected to condition future outcomes. As an example, there is a commonly argued link between a country's economic development and the rise of democracy. The argument goes that once a country reaches a certain level of economic development, there then exists a configuration of cultural factors that have a higher probability of tripping the switch that creates a transition to democratic rule (Parzen, 1960). For the purposes of this research, idealized payoff matrixes will be created based upon empirical observations to provide a justification for applying codes to chunks of data collected. Codes will then be grouped into concepts to support the categories underpinning the theory. The theory, categories, concepts and codes will relate to each other as an "irresistible analogy" (Bourdieu, 1980, p. 200) to explain the main issue, in this case whether pedagogical capital can be visualized as real and having a real effect, thereby lending credence to the term being added to the educational research lexicon. CGT can be used with both quantitative and qualitative data, which makes it well-suited for a mixed-methods approach.

Working Hypothesis

One of the hallmarks of qualitative research is theory generation based upon themes that emerge during the collection of the data. Both case study and CGT compare common patterns as they emerge across the data collection field as new insights are noted. In this research, rather than waiting until the end of the data collection cycle to perform inferential statistics (as though the data collection site is a sterile field and must not be interfered with), field notes, journal notes, statistical analysis, and classroom observations informed the course of the research as it proceeded. Notes regarding how the course of the research was informed as the data emerged and was analyzed are included in the Results section in the manner in which they presented themselves.

Inferential Statistics

Students will be quizzed once every two weeks using five versions of the same quiz for the entire school year to create a portrait of their overall level of fluency with regard to the multiplication pairs as this portrait emerges during the school year. Third grade students will only be quizzed on the pairs from 0x0 up to 9x9, or all of the single digit pairs. See Appendix C for these five quizzes. The quiz was based upon the *Alabama Course of Study: Mathematics* for grade 3 (Alabama Department of Education, 2003). These quizzes will be marked for correctness and scores assigned on the basis of 100% being the score for all correct answers.

Students who scored between 80-100% were assigned Level IV (exceeds academic content standards). Students who scored between 60-79% were assigned Level III (meets academic content standards). Students who scored between 40-59% were assigned Level II (partially meets academic content standards). And, students who scored between 0-39% were assigned Level I (does not meet academic content standards). These levels were merely convenience labels and were not used in any quantitative analysis. However, they helped to create a portrait of the variance in the two school populations as the year progressed.

Inferential statistical analysis was performed using the Statistical Package for the Social Sciences (SPSS). The two sample populations will come from the two different schools, so the samples will be independent. The hypothesis to be evaluated for detecting a difference between the mean scores on multiplication pair quizzes will be as follows: $\boldsymbol{H}_o$: $\mu_1 - \mu_2 = \mathbf{0}$ where μ_1 is the quiz mean for sample 1 and μ_2 is the quiz mean for sample 2. Two-sample *t*-tests were conducted each week. If there turns out to be a statistically relevant difference between the two student populations taking the multiplication pairs, that quantitative difference will lend credence to any qualitative differences that may emerge from the teacher, parent, and student interviews.

Limitations

The following are limitations to this study: Although other school districts may find a resemblance to this study in their own schools, the findings of this research can be expected to apply specifically to the two schools in question. Thus, the findings of the research in this study may not be transferable to other contexts.

The participants will be asked to voluntarily take part in this study through purposive sampling. The sample size will consist of 4 teachers, approximately 100 3^{rd} grade students, all willing parents. Limitations will include small sample size, inherent bias among the participants, and generalizability. And as in any research, the theoretical perspective of the researcher will come to bear on the analysis of the data.

Standards for Qualitative Research

An inquirer needs to be able to persuade his or her audience (including self) that the findings of the inquiry are worth paying attention to and worth taking account of. The arguments that are mounted, the criteria and methods that are invoked, and the questions that are asked are the tools of persuasion. Lincoln and Guba (1985) contend that the trustworthiness of the study can be measured if one "invokes the criteria of credibility, transferability, dependability, and conformability" (p. 219).

Credibility (also known as internal validity) is defined as the "approximate validity (the best approximation of the truth or falsity of statement) with which we infer that a relationship between two variables is causal or that the absence of a relationship implies the absence of cause" (Lincoln & Guba, 1985, p. 290). To ensure the creditability of the data collected in this study, data from multiple sources and over a period of time will be collected and assessed.

Transferabilty (also known as external validity) refers to the generalization of, or the ability to apply the findings of, the data and analyses to other settings. Generalization includes two contexts: empirical and theoretical. As transferability in qualitative studies is not always achievable, it then becomes the duty of the researcher to make the transfer applicable between studies instead (Lincoln & Guba, 1985). To ensure transferabililty of the findings of this study to other settings, I will follow in the footsteps of Bourdieu and attempt to show an "irresistible analogy" (Bourdieu, 1980, p. 200) with a strongly connected theoretical perspective, data collection, and method of analysis that is high in social utility.

Dependability and confirmability in a qualitative study are suggested by the techniques of an audit inquiry and an audit trail. The Halpern audit trail system suggested by Lincoln and Guba consists of six categories:

> (1) raw data, including electronically recorded materials, written field notes, documents and records, and survey results, (2) data reduction and analysis products, including field notes, unitized data (3 x 5 cards) and theoretical notes, (3) data reconstruction and synthesis products, including structure categories (themes and relationships), findings and conclusions (interpretations and inferences), and a final report, (4) process notes,

> including methodological notes (procedures, designs, strategies), trustworthiness and audit trail notes, (5) materials related to intentions and dispositions, including personal notes (reflexive notes and motivations), and expectations (predictions and intentions), and (6) instrument development information, including pilot forms, preliminary schedules, observation formats, and surveys (Lincoln & Guba, 1985, p. 319).

In accordance with the Halpern audit trail notational system described above, all relevant data pertaining to this case study will be systematically documented and stored to ensure dependability and confirmability.

Summary

The theoretical perspective of a qualitative study is the canvas on which the warrants that connect the data to the interpretation is painted. This chapter provided a rationale for the design of this study, an explanation of and the theoretical basis for the methodology to be used, and the procedures to be followed for data collection and analysis. It was shown that the research paradigm selected, the methodology to be used, and the motivations of the researcher share the same theoretical perspective and ideological underpinnings. The limitations and standards for qualitative research were also presented.

CHAPTER 4

RESULTS

Introduction

Multiplication pair quizzes were given bi-weekly at two elementary schools for one school year beginning in late August and continuing until late May. The school considered to have the greatest amount of pedagogical capital was labeled as A LOT and the school considered to have less pedagogical capital was labeled NOT MUCH. The terms “a lot” and “not much” were also used as CGT categories.

The average age of the teachers at A LOT was 58 years, with 17 years being the average number of years experience teaching school. This value was slightly misleading because one teacher (white female, aged 56) had 26 years of experience and a master’s degree. She had been teaching 3rd grade at A LOT for 12 years. The other (white female, aged 60) had attended college to become a teacher late in life and had been teaching for only 8 years and had no plans to pursue a higher degree. She had been teaching 3rd grade at A LOT for 3 years. Both said in private interviews that their students were usually at or above grade level. Twelve years ago, there had been a demographic shift with the opening of another elementary school in this affluent area of town. A LOT was located in a stable, suburban neighborhood with attractive homes on large lots. All of the students had addresses at a house. During this research, no student moved into or out of the school during the academic year. There were 53 children in the two classes at A LOT. Table 4 shows the demographic make-up of the student population at A LOT.

Table 4

A LOT Demographics

Race	Gender: Male	Gender: Female
White	19	28
Black	3	2
Asian	0	1

There were sidewalks lining the streets in the immediate area of A LOT, and every Thursday was designated as "Walk to School Day." Depending upon the weather, numerous parents (mostly mothers) walked their children to school, even going so far as to walk the child to their classroom. On other days, many parents (about an equal number of mothers and fathers) drove their child to school and dropped them off in the carpool line. A few others parked in a lot adjacent to the school and walked their child to their classroom. The teachers said that parental support was very high. The major fund-raiser occurring at A LOT during the course of the research was the building of a specialized playground with a walking track, rock-climbing area, and other strength-building activities. By the end of the research, $214,575 of the needed $300,000 had been raised for this project and the playground was under construction. These types of parental behaviors were coded as "concerted cultivation," "school/home intertwined," "logical practice," and "systematic support" for the purposes of CGT.

Both teachers at A LOT maintained a class website on the school server which was updated each week. There were numerous links for parents and children to follow, along with school information, testing information, and numerous reminders about upcoming events and academic goals. Both teachers said that the math curriculum materials selected for use (Saxon Math 3) (Larson, 2004) did not push their students enough. It was usual for them to begin introducing the 4th grade curriculum during the second semester (Saxon Math 5/4) (Hake & Saxon, 2004). One of their goals for their students, which was also published on their websites, was to master answering the 100 single digit multiplication facts on a quiz in under 5 minutes by Christmas, and in under 4 minutes by May. During the course of this research, 78.7% of the students were able to meet the 5 minute goal by Christmas, and 72.7% met the 4 minute goal by May. These types of teacher behaviors were coded as “concerted cultivation,” “school/home intertwined,” “logical practice,” and “systematic support” for purposes of CGT.

The average age of the teachers at NOT MUCH was 32 years, with 6 years being the average number of years experience teaching school. One teacher (white male, aged 26) had a master’s degree and had been teaching 3rd grade at NOT MUCH for 4 years. The other teacher (black female, aged 38) was working on completing her master’s degree and had been teaching at NOT MUCH for 7 years. Both teachers said in private interviews that they typically had a diverse group of learners, both academically and behaviorally. Most students were at grade level, with a few above and below. NOT MUCH was located in a working class area with modest homes on small lots. NOT MUCH was considered to be a transient school. 82.9% of the students had an address at a house and 17.1% had an address at either an apartment or a mobile home lot. During this research, 3 students moved into the school and 5 students moved out during the academic year. There were 39 children in the two classes at A LOT during the course of the research. Table 5 shows the demographic make-up of the student population.

Table 5

NOT MUCH Demographics

Race	Gender	
	Male	Female
White	14	16
Black	5	3
Native American	0	1

The school was hemmed in about two blocks away by a major highway and a railroad to the east and west, and a second major highway and a neighborhood to the north and south. There were no sidewalks and very few children were ever seen to walk to school; just a handful that lived in the adjacent neighborhood. Some parents drove their child to school, but typically they remained in their vehicle in the carpool line, driving off after the child was dropped off. The teachers said that parental support was weak, and that the parents seemed immature, unorganized, and needy. They said there was limited support with behavior or homework. The major fund-raiser at NOT MUCH during the course of the research was the selling of coupon books for $20 and cookbooks for $20, for which the school received $10 respectively. By the end of the research, 254 coupon books and 113 cookbooks had been sold netting the school $3,670. These types of parental behaviors were coded as “accomplishment of natural growth,” “school/home separate spheres,” and “logical practice” for purposes of CGT.

NOT MUCH has a school website where the teachers could post goals and assignments, but neither of the two teachers were using it during the research. Both teachers expressed concern that the math curriculum materials selected for use (Saxon Math 3) (Larson, 2004) did not begin to introduce multiplication concepts until very late in the school year. The math curriculum material is scripted, and both teachers planned to follow the prescribed scope and sequence. The teachers planned to use a variety of resources to teach multiplication. They had no specifically stated goals other than having their students do their best to learn the 100 single-digit multiplication facts by the end of the school year. These types of teacher behaviors were coded as "accomplishment of natural growth," "school/home separate spheres," and "logical practice" for purposes of CGT.

Both A LOT and NOT MUCH began the year using the same math curricular material (Saxon Math 3) (Larson, 2004) which was coded as "logical practice" for CGT. The program philosophy of Saxon Math is based upon incremental development and continual review so that "students are given the time to develop a deeper understanding of concepts and how to apply them" (Hake & Saxon, 2004, p. T13). The 3rd grade material has 135 lessons. The single digit math facts are introduced in the following order in the lessons listed in Table 6.

Table 6

Introduction of Math Facts: Saxon Math 3[a]

Lesson #	Fact Introduced
45	1 and 10
55	7
63	Squaring Numbers
70	2
85	0 and 5
95	3
100	4
110	9
115	6
120	8

[a]summarized from table of contents

I met the four 3rd grade teachers at each of their schools at the beginning of the school year. The teachers were not made aware of the other school. Thursday was selected as the day of the week to give the bi-weekly quizzes to the students. A LOT had their math time beginning at 8:00 am and NOT MUCH had their math time beginning at 11:45 am. A 15 minute time frame was given to each of the two classes at each school. One of the teachers at A LOT expressed a concern that her students were prone to memorize answers in order, so it was decided to make five versions of the quiz by switching the order of the five columns. Since the quiz was made with an Excel spread sheet, it was an easy cut and paste to make this modification in the data collection.

One child at A LOT finished the 100 multiplication facts on the first day of quizzing. I was using a kitchen timer at the time, which counted down from 7 minutes, so I noted on the top of her quiz what time remained when she finished. As the children at A LOT gained proficiency, it became apparent that writing the time for each child would be problematic, even with the classroom teacher helping me by starting a second timer at the same time as me. A colleague suggested using a Teach Timer, but that has a small display and several would be required around the classroom. It would also be necessary to make sure that the children started all of the timers at the same time. I looked into purchasing a large timer such as those used at sporting events, but even a display the size of a laptop computer would be cost prohibitive. I ended up creating a Powerpoint slide show that counted the time up from 0:00 to 7:00. Each slide was set to advance at one second intervals. The children were instructed that, if they finished the entire quiz, they should look at the display and write down the time shown. The slide show ended with a “ta-dah” sound and slides that blinked “Times Up! Pencils Down!”

There was no feedback loop in place, so the children did not know what their score was on a previous quiz, and with the two week lag between quizzes, they did not seem to remember what their previous time was. As a management procedure, during the first day of quizzing, I noticed that it was taking much more of the allotted 15 minutes of class time than I was comfortable with to make sure that all of the students wrote their first and last name on their quiz. I began to initiate each quiz using the same procedure. I passed the quizzes out around the room, and then put any extras back in my pocket folder. After doing that, I would say to the children, “If you have your first name on your paper, you have one hand in the air. If you have your last name on your paper, you have both hands in the air with your pencil and you are in the starting position ready to dive in.” After all of the children had both hands in the air as though they were about to dive into a swimming pool, I would start the quiz by saying, “On your mark. Get set. Dive!” During the course of the research, students were quizzed on 18 different occasions during the school year. A total of 1,399 quizzes were administered and assessed, 835 at A LOT and 564 at NOT MUCH. Only one quiz was missing a last name, and only one quiz had no name at all. Also, as another management procedure, it was noted that as the children at A LOT began to finish, the “fast finishers” caused a mild distraction to those still working by whispering to their peers what time they had and counting down to the “ta-dah.” I spoke to the children once after that quiz and said that the “fast finishers” had had the luxury of a quiet classroom while they worked, so wasn’t it only fair that their peers deserved the same. I also discussed that finishing fast did not necessarily make one better, it just made one faster. I referred to speed in swimming, since we were already “diving” to begin the quiz. I said that all students could probably swim, but that it was natural for some to be faster than others. There were no more distractions during quizzing at A LOT after this. There were never any distractions during quizzing at NOT MUCH.

Quantitative Results

From the classroom observations during the quizzes, the students at A LOT began the course of the research seemingly understanding the repeated addition nature of multiplication. They were observed counting on their fingers and quietly skip-counting by 2s and 5s. This behavior was nearly absent at NOT MUCH on the day of the first quiz. Only one of the students answered the items one after another. This was a black girl at A LOT who had moved here from Australia during the previous summer. She completed the entire quiz correctly on the first round. All of the other students "searched" the quiz for the facts they knew and did not attempt to answer those they did not know. This "searching" behavior would continue to be exhibited during the course of the research until a point was reached where the child was fluent in all 100 facts. "Searching behavior" was used as a CGT code. The students at A LOT began the year fluent in the 0s and 1s, and would skip-count the 2s and 5s. With those four families of facts firmly established, a minimum quiz score of 64 was possible on the first quiz. This could explain the higher beginning score at A LOT.

Most of the children at NOT MUCH also exhibited the "search" behavior, and did not attempt to answer the ones they did not know. Two white girls attempted to answer additional facts after doing the "search" behavior. They went back to the beginning of the quiz and began to answer the items one after another. One wrote random answers, sometimes writing the multiples of ten, and the other swapped the order of the multiplication pair to create an answer. Both girls had a score of 2 on that first quiz. Students at NOT MUCH were more likely to err with the 1s, 0s, and the square numbers, and most did not seem to understand the repeated addition nature of multiplication because most did not make the connection to skip-count using their fingers for the 2s and 5s (or to count on their fingers for any answer for that matter) until later in the first semester. This could explain the lower beginning score at NOT MUCH.

As the research unfolded, the children at both schools began to add columns of numbers on the margins of their quiz, to draw dots or sticks to count, to list columns of skip-counting, to count on their fingers, and to skip-count using their fingers. Other students were observed to look at the calendar to answer some of the 7s. Because I did not know what to call this phenomenon, I preliminarily labeled this behavior as “adaptive compensation” and used it as one of my CGT codes. I wanted to note that the child lacked fluency in knowing the answer to the multiplication pairs, but wanted to acknowledge that they understood the repeated addition nature of multiplication because they exhibited a plan of action to derive an answer. They compensated for their lack of fluency by adapting their behaviors. This behavior stood out because it was different from those children who did not attempt an answer at all.

As a part of my working hypothesis, I justified the use of the term “adaptive compensation” by borrowing a term from physics as Bourdieu did in borrowing *vis insita* as the power of the *habitus* to resist change and *lex insita* as the principle that underlies the order of the social world. In physics, “adaptive compensation” is a method used when an image (ultrasound) or signal (acoustics) is received in a disturbed manner (for instance the wrong answer). If the initial phase or magnitude of a sound wave is known (for instance the initial 2-by-2 matrix of a multiplication pair), then a filtering procedure can be employed (for instance the use of adaptive compensation), which results in a high quality image/signal (for instance obtaining the correct answer) (Krishnan, Li, & O’Donnell, 1996, Kolmogorov & Kryuchkov, 2009). This is what the children seemed to be doing when they exhibited what I call “adaptive compensation.” They knew or suspected that their initial idea of the answer was wrong (or they just didn’t know what the answer was), so the filtering procedure they used was to return to the initial 2-by-2 multiplication pair matrix to produce a correct answer via repeated addition or simply by counting.

The quizzes from both schools were graded the week they were given and the data was inserted into both SPSS and an Excel spreadsheet for data management and analysis. It was meant to guide me in what types of questions I would ask the classroom teacher the following week. Oftentimes, a finding that appeared unusual or surprising one week could be better understood if I inquired about it the following week which continually informed my working hypothesis. Table 7 lists the mean aggregate scores for each school and the change in score from the previous quiz for each of the 18 quizzes administered. Quizzes 1-9 represent the fall semester and quizzes 10-18 represent the spring semester.

Table 7

Quiz Score Averages per School

Quiz #	A LOT	Increase	NOT MUCH	Increase
1	55.35		23.79	
2	56.84	1.49	24.37	0.58
3	60.90	4.06	27.78	3.41
4	63.18	2.28	32.75	4.97
5	67.49	4.31	43.70	10.95
6	83.14	15.65	43.74	0.04
7	92.04	8.90	51.41	7.67
8	96.92	4.88	56.38	4.97
9	97.34	0.42	56.88	0.50
10[a]	96.32	-1.02	51.31	-5.57
11	97.07	0.75	56.23	4.92
12	97.41	0.34	56.07	-0.16
13	99.10	1.69	64.40	8.33
14[b]	98.64	-0.46	63.53	-0.87
15[c]	97.95	-0.69	68.56	5.03
16	98.98	1.03	71.43	2.87
17	99.16	0.18	71.17	-0.26
18	99.33	0.17	71.87	0.70

[a] week after Christmas holiday
[b] week after spring break
[c] week after standardized testing

I was curious why most of the students at NOT MUCH were not exhibiting any “adaptive compensation” like skip-counting on their fingers during the initial three quizzes. After 3 rounds of quizzing, I made a field note to ask the teachers at NOT MUCH during quiz 4 if they felt their students understood that they could skip-count using their fingers by 2s or 5s to come up with the answers for some of the multiplication pairs. The 3rd grade math curriculum materials had not yet introduced multiplication for the year. My question may have prompted the two teachers at NOT MUCH to work on this “adaptive compensation” technique during the following two weeks. More of the children were observed skip-counting with their fingers during quiz 5 and thereafter. This could explain the 10.95 increase in the average score from quiz 4 to quiz 5 at NOT MUCH since the math curricular material had not yet introduced multiplication for the school year.

The largest increase in quiz scores during the entire course of the research occurred at A LOT during quiz 6 when the average score leaped by 15.65 points. The teachers at A LOT had informed me ahead of time that they would not follow the course and sequence of Saxon Math 3. They had specific goals for the children to have fluency in the multiplication pairs. They also had a plan of action to attain that goal. Depending heavily upon parental support galvanized over the years working with older siblings and a historical precedence seemingly set at the school, the use of their class websites for real-time communication and web-based resources, and a 3rd grade parent meeting held early in the fall semester, they invited/demanded all students to begin working toward mastery of all 100 single digit facts on Halloween Day. Their theme was “There’s Nothing Spooky About Multiplication.” Students were taken to the computer lab that day for their math class to become acquainted with the various web-based resources on the teachers’ websites. The teachers told me that they did this because they wanted the children to become aware of how many facts they already knew so that they could “know” that they did not have many more facts to learn. I coded this deviation from the prescribed math curriculum scope and sequence as “concerted cultivation,” “home/school intertwined,” “logical practice,” and “systematic support” while following the scripted scope and sequence alone was coded as "accomplishment of natural growth" and "logical practice." By quiz 7, which occurred before Thanksgiving, the average quiz score at A LOT was above 90% and would remain above it, approaching 100% before the end of the school year.

The students at NOT MUCH had subsequent increases in their average quiz scores during quiz 7 (7.67) and quiz 8 (4.97). The teachers told me that Saxon Math 3 had introduced the 1s and 10s prior to quiz 7. This pattern of increases would continue throughout the school year and could be correlated to the introduction of additional fact families, which was occurring very slowly as the teachers had initially noted to me.

Independent two-sample *t*-tests for Equality of Means were performed to compare the average scores between A LOT and NOT MUCH for each quiz administered. As shown in Table 8, the difference between the two means for the two schools had a p-value of less than .05 for every quiz given, thus making each difference significant.

Table 8

Independent Samples Test: Scores

Quiz #	T-test for Equality of Means				Levene's Test for Equality of Variance	
	Mean Difference	t	df	p*	F	α**
1	31.561	7.136	63	.000	.173	.679
2	32.472	7.504	84	.000	1.827	.180
3	33.117	8.071	79	.000	.298	.587
4	30.426	7.528	81	.000	.664	.418
5	23.793	5.814	82	.000	.979	.325
6	39.398	10.355	79	.000	.073	.788
7	40.633	13.834	75	.000	3.565	.063
8	40.545	15.759	80	.000	42.471	.000
9	40.465	20.962	83	.000	35.878	.000
10[a]	45.006	12.980	74	.000	33.966	.000
11	40.841	12.303	74	.000	41.386	.000
12	41.342	12.180	72	.000	43.926	.000
13	34.691	10.428	74	.000	54.525	.000
14[b]	35.105	11.372	74	.000	55.683	.000
15[c]	29.391	10.015	73	.000	86.588	.000
16	27.544	9.661	73	.000	87.170	.000
17	27.983	9.753	72	.000	127.557	.000
18	27.467	7.931	73	.000	85.135	.000

[a] week after Christmas holiday
[b] week after spring break
[c] week after standardized testing
*$p < .05$.
**$\alpha > .01$.

Interestingly, it was Levene's Test for Equality of Variance that began to tell the story about the change in variability between the groups as the school year progressed. During quizzes 1 through 7, the Levene's Test values were all greater than .01, so the groups were considered to be homogenous. However, by quiz 8, the value became less than .01 and remained so for the entire duration of the research, even though the mean difference between the two schools peaked at quiz 10 and then began to fall, with the differences becoming lower than the initial mean difference by quiz 18. To highlight this variability, students' scores were categorized into academic content knowledge level indicators as previously mentioned in the Methods chapter.

Students who scored between 80-100% were assigned Level IV (exceeds academic content standards). Students who scored between 60-79% were assigned Level III (meets academic content standards). Students who scored between 40-59% were assigned Level II (partially meets academic content standards). And, students who scored between 0-39% were assigned Level I (does not meet academic content standards). These levels were used as CGT codes. Table 9 shows the percentages of students assigned to each content knowledge level indicator as the year progressed.

Table 9

Academic Content Knowledge Level Indicator Percentages

Quiz #	A LOT				NOT MUCH			
	IV	III	II	I	IV	III	II	I
1	6.5	38.7	41.9	12.9		5.9	8.8	82.4
2	11.8	45.1	19.6	23.5		5.7	17.1	74.3
3	14.3	57.1	2.0	16.3		6.3	12.5	78.1
4	15.7	54.9	15.7	13.7		6.3	18.8	75.0
5	27.5	49.0	7.8	15.7		15.2	36.4	48.5
6	64.0	24.0	12.0		3.2	12.9	41.9	41.9
7	86.0	14.0			3.7	33.3	40.7	22.2
8	98.0	2.0			6.3	40.6	40.6	12.5
9	98.1	1.9			9.4	34.4	50.0	6.3
10[a]	97.7	2.3			15.6	15.6	34.4	34.4
11	97.8	2.2			12.9	25.8	38.7	22.6
12	97.7	2.3			16.7	23.3	40.0	20.0
13	100.0				26.7	36.7	23.3	13.3
14[b]	100.0				21.9	37.5	21.9	18.8
15[c]	97.7	2.3			31.3	28.1	40.6	
16	100.0				33.3	33.3	30.0	3.3
17	100.0				34.5	37.9	27.6	10.3
18	100.0				46.7	30.0	13.3	10.0

[a] week after Christmas holiday
[b] week after spring break
[c] week after standardized testing

Notice that at the beginning of the school year, the students are spread throughout the four content knowledge level indicators, even though the students at NOT MUCH would not be represented in level IV until quiz 6. By quiz 8, when Levene's Test for Equality of Variance began to show non-homogenous groups, 98% of the students at A LOT were now at level IV. While the students at NOT MUCH continued to be spread out among the four levels for the duration of the school year, more than 97% of the students at A LOT remained in level VI, with levels II and I not represented at all. While the comparisons of the quiz scores is enlightening, and while Levene's Test pointed to the time where the variability of the group's scores began to change, others factors were at play in and out of these classrooms also.

Since the teachers at A LOT had a goal of the students mastering all 100 facts in under 5 minutes by Christmas and in under 4 minutes by May, the amount of time it took the child to complete the quiz was recorded on each quiz, provided that the child completed in the 7 minutes consistently allotted. While it is a given that these average times do not represent true means of the population, since it is possible that any child could complete the quiz given enough time, an analysis of those who were able to complete the quiz in the time allotted added detail to the portrait of what was occurring in each of the two schools. Table 10 lists the average times for completion at each school.

Table 10

*Average Time to Complete Quiz**

Quiz #	A LOT			NOT MUCH		
	Time	Percentage Completing	Change	Time	Percentage Completing	Change
1	5:07	1.9				
2	5:47	3.8	-0:40			
3	5:37	3.8	0:10			
4	5:29	3.8	0:08			
5	4:02	3.8	1:27			
6	5:41	26.4	-1:39			
7	5:07	58.5	0:34			
8	4:25	79.2	0:42			
9	4:16	88.7	0:09			
10[a]	4:46	75.6	-0:30	6:23	3.0	
11	4:32	80.0	0:14	5:15	3.0	1:08
12	4:31	82.2	0:01	5:43	3.0	-0:28
13	3:52	95.6	0:39	6:36	6.1	-0:41
14[b]	3:47	93.3	0:05	6:08	6.1	0:28
15[c]	4:11	88.9	-0:24	5:53	9.1	0:20
16	3:50	95.6	0:21	6:09	18.2	-0:16
17	3:34	97.8	0:16	5:37	21.2	0:32
18	3:28	97.8	0:06	5:13	24.2	0:24

*for those who finished in under 7 minutes only
[a] week after Christmas holiday
[b] week after spring break
[c] week after standardized testing

Since quiz 6 represents the first quiz given after the "There's Nothing Scary About Multiplication" theme began, it is not surprising that an additional 54.7% of the children at A LOT were able to complete the quiz in under 7 minutes during the weeks when quizzes 6 and 7 were administered. Even though A LOT never attained having 100% of the students finish in under 7 minutes by the end of the school year, recall that 100% of them were at Level IV. The one child who never completed any of the quizzes in under 7 minutes was a white male whose scores ranged from 75 to 93 during the spring semester. 88.7% of the students at A LOT were able to meet the under 5 minute goal by Christmas and 97.8% were able to meet the under 4 minute goal by May. None of the children at NOT MUCH were able to complete the quiz at all before Christmas, and only 24.2% were able to complete the 100 multiplication fact quiz by May, with an average time of 5:13.

I labeled this ability to meet the earlier time goal, the under 5 minute time goal, as "automaticity." The word "automaticity" was used in passing by one of the teachers at A LOT to me when I mentioned in early December that the children seemed to be getting faster. I wasn't sure what she meant by the term at the time. Subsequent research on my part during the following week disclosed that the term "automaticity" is usually associated with reading and literacy in the elementary schools as a technique to become a fast and efficient reader. This teacher had apparently borrowed this term and applied it to attaining fluency in the multiplication pairs. The following week, a couple of questions confirmed that this is what she had done. Since those students considered to have "automaticity" were also no longer exhibiting "adaptive compensation" as they completed the quizzes, this behavior was different so "automaticity" was included in CGT as a code.

Independent two-sample *t*-tests for Equality of Means were performed to compare the average times to complete the quiz between A LOT and NOT MUCH for each quiz administered even though it is acknowledged that these times do not represent a true mean for the populations since not all of the children were allowed to complete the quiz. I was curious as to whether there was a significant difference between the times for at least those who were able to complete the quiz in the 7 minutes allotted.

Table 11

Independent Samples Test: Average Time[a]

Quiz #	T-test for Equality of Means				Levene's Test for Equality of Variance	
	Mean Difference	t	df	p*	F	α**
10[b]	-1:37	-1.498	33	.144	-	-
11	-0:43	- .649	35	.521	-	-
12	-0:55	- .806	36	.426	-	-
13	-2:44	-3.551	43	.001	1.260	.268
14[c]	-2:20	-3.081	42	.004	.425	.518
15[d]	-1:43	-2.465	41	.018	1.877	.178
16	-2:19	-4.941	47	.000	2.113	.153
17	-2:02	-4.461	49	.000	1.002	.322
18	-1:45	-4.377	50	.000	.119	.731

[a]for those who finished in under 7 minutes only
[b] week after Christmas holiday
[c] week after spring break
[d] week after standardized testing
*$p < .05$.
** $\alpha > .01$

As shown in Table 11, the difference between the two means for quizzes 10-12 had a p-value of more than .05, thus making those differences not significant. However, note that there were also no F-scores computed for quizzes 10-12. This is because there was only one child at NOT MUCH who was able to complete the quiz during this time period so there was no variance to compare. For the subsequent quizzes, other children at NOT MUCH began to be able to complete the quiz in under 7 minutes, and each quiz from thereon has a p-value of less than .05, thus making the difference in time to complete these quizzes significant from thereon. Also, from that point on, the F-scores were greater than .01 meaning that the populations of those completing the quiz had homogeneity of variance. This gave credence to applying the code of "automaticity" to some of the children. There was no comparative testing on the times for quizzes 1-9, since no child at NOT MUCH completed the quiz in under 7 minutes before Christmas.

Qualitative Results

The qualitative results will be broken down into concepts that emerged through interviews and weekly discussions with the teachers and comments made by the children which were recorded in the field notes. Also to be used are three one-question surveys given to the children at both schools after the initial introduction of multiplication for the school year and by telephone interviews with parents. This information will be used to paint a portrait of the children's fields of play by creating idealized payoff matrixes generated from some of the empirical data collected during the course of the research. While it is not assumed that they will perfectly describe the structure of the true field, these matrixes will provide justification for the assignment of codes. Some of the codes to be used have already been identified and were discussed in the section on quantitative results. All are included in Table 12.

Table 12

Codes for Classic Grounded Theory

Code	Assigned To
Searching Behavior	Child
Adaptive Compensation	Child
Automaticity	Child
Focused at Home Activities	Child, Parent, Internet
Random or No Home Activities	Child, Parent
Logical Practice	School, Teacher, Parent, Internet
Systematic Support	School, Teacher, Parent, Internet
School/Home Intertwined	Teacher, Parent
School/Home Separate Spheres	Teacher, Parent
Concerted Cultivation	Teacher, Parent, Internet
Accomplishment of Natural Growth	Teacher, Parent
A Lot	School, Child, Parent, Internet
Not Much	School, Child, Parent
Level IV	Child
Level III	Child
Level II	Child
Level I	Child

The teachers in this research were interviewed using the interview protocol in Appendix A and by weekly questioning informed by the emergent data analysis. Some of the results of those interviews have already been discussed in the section on quantitative results and as such that discussion will not be repeated here.

In a distinct behavior exhibited at A LOT, the teachers, parents and children seemed to work as an informed team with the teacher being the team leader who set goals for the group and for student learning, sometimes even above and beyond the minimum state requirements. An example of teamwork was a motto at A LOT with the school even having posters in the hallway proclaiming “TEAM A LOT” with “TEAM” being an acronym for “Together Everyone Achieves More.” An example of how the group was kept in a continual information loop is the use of the class website and by an expectation that papers sent home to parents would arrive back at school in a timely manner. On the returning of papers, the teachers at A LOT had a policy that papers returned the next day were deserving of the child receiving a Skittle. Papers returned on the second day were deserving of the child receiving a "Thank you," and papers returned any later were deserving of the child being assigned to silent lunch. An example of a group goal is that the parent would assist the child at home. An example of a student goal that was above and beyond the requirements of the prescribed scope and sequence was the mastery of the 100 multiplication facts in under 5 minutes before Christmas in under 4 minutes by May. An example of a parent goal that was above and beyond the norm was the fund raising of nearly $300,000 for the specialized playground. It is noted that this goal is one that the parents set for themselves and was not a teacher goal. Not only was the team concept continually maintained and constantly informed during the course of the research, but all goals set were overwhelmingly accomplished by the majority of the students. These behaviors were distinct to this school so the parents and teachers at A LOT were given the codes "concerted cultivation," "school/home intertwined," "logical practice," and "systematic support."

On the other hand, the teachers at NOT MUCH struck me as "the little old lady who lived in a shoe, who had so many children she didn't know what to do." Considering that the average number of students per class at A LOT was 26 and only 17 at NOT MUCH, this struck me as odd. The students at both schools were equally friendly, talkative, and supportive during quiz day, so it didn't seem that behavior was the culprit. The teachers at NOT MUCH said that parental support was weak, and that the parents seemed immature, unorganized, and needy. They said that the children also displayed these same sorts of behaviors. The teachers also told me that after completing paperwork for free/reduced lunch, code of conduct forms, and the permission slips for this research on the first day of the school year, they rarely sent things home to parents because things were unlikely to be returned. They also did not assign homework since it was not likely to be completed or returned. There seemed to be a lack of communication between the parent and teacher, and there was no plan of action to try to bridge this gap. Rather than being the leader of a cohesive team who set goals for the group, these teachers tended to set only the minimum required goals for their students and then hoped for the best as they labored alone in their classrooms. The parents did not seem to involve themselves in what could have been a larger and more cohesive and efficient team. Not only was there no team concept present at NOT MUCH, there was also an absence of an information loop. In other words, while the teachers stated that they would like to have assistance from the parent, they were unlikely to ask for it. This reminded me of my example of the Marxist scheme in my theoretical framework where a lack of money produced the habit of not attempting to buy books. The teachers at NOT MUCH had a habit of not asking for parental assistance perhaps because the organizing structure of the school was such that there was not much pedagogical capital to begin with. The minimal goals set for the students were accomplished by a small number of the children, in this case only 24.2% of the students could complete the 100 multiplication facts in under 7 minutes by the end of the school year. (However, it is noted that completing the 100 multiplication facts in under 7 minutes was not a teacher goal, but merely a research parameter.) This behavior was distinct to this school so the parents and teachers at NOT MUCH were given the codes “accomplishment of natural growth,” “school/home separate spheres,” and “logical practice.”

The week after A LOT began “There’s Nothing Spooky About Multiplication” happened to coincide with the introduction of the 1s and 10s in Saxon Math 3. Both schools had begun the introduction of multiplication at roughly the same time. But since the approach planned by the teachers at A LOT was so distinctly different from that of the teachers at NOT MUCH, this teacher behavior was coded as “concerted cultivation” and “systematic support” at A LOT and as “accomplishment of natural growth” and “logical practice” at NOT MUCH.

At the administration of the quiz that week, a one question survey was printed on the back of the quiz (see Appendix D). When the children at both schools finished the timed quiz for that week, they were asked to turn their paper over and bubble in the things that they had been doing to learn the multiplication facts during the past week. The children at both schools were reassured that there were no right or wrong answers, that there were only true answers. Only one white male at A LOT said that he forgot to study at home which represented 2% of the students. The other 98% of the children selected numerous activities they had been doing at home, even adding some to the list that I had not thought of. The website www.multiplication.com was the resource that the majority of the children said helped them the most. The use of flashcards, worksheets, and a kitchen timer were the resources that the children were next most likely to say were helpful. At NOT MUCH, 81% of the students said that they forgot to study at home, while 19% said that their at home activity was counting on their fingers. Since these behaviors at A LOT and NOT MUCH were distinct, I coded the children at A LOT as “focused at home activities,” “concerted cultivation,” and “systematic support.” The children at NOT MUCH were coded as “random or no home activities” and “accomplishment of natural growth.”

The following week, a second one question survey was printed on the back of the quiz. Perhaps the websites and resources listed on the first survey question had prompted some of the children to explore them because several students at both schools told me that they had tried them, particularly www.multiplication.com. The male teacher at NOT MUCH had read the survey question the week before, and he told me that this week he had been using www.multiplication.com as a math center each day. However, rather than asking again what they were doing at home to learn the multiplication facts, the survey question this week dealt with who had helped the child at home during the past week. I deliberately paced the questions so that the question for the following week would not be informed by the question from the previous week. At A LOT, 59% of the children said that their mom was helping them, 21% said their dad was helping, and 20% selected one of the other choices. On the part of the question concerning who was the most helpful, 41% selected mom, 16% said dad, 30% said their teacher, and 13% found studying alone to be the most helpful. At NOT MUCH, 22% said that mom was helping, none of the dads were helping, 29% selected one of the other choices, and 49% said that they forgot to study at home. On the part of the question concerning who was the most helpful, 27% selected mom and 73% selected their teacher. These answers justified coding the teachers and parents at A LOT as "school/home intertwined" and "systematic support" while the teachers and parents at NOT MUCH as "school/home separate spheres." Since for the past two weeks an overwhelming number of children at NOT MUCH said that they were not studying at home, I orally questioned the kids before beginning the quiz for that week. I asked them, "How many of you get home … and you start to play or watch television … and the next thing you know it's dinner time … and the next thing you know it's time for bed … and you just never think about reading or studying?" Nearly every child raised their hand to agree with this. I coded this child behavior as "played after school."

That same week I also sent a letter home to each of the parents at both A LOT and NOT MUCH. I asked them to please call me at their convenience for a telephone interview. I included the interview protocol in the letter so that they would know ahead of time what questions I planned to ask (see Appendix B). I had deliberately planned the timing of the two child survey questions before approaching the parents for questioning. My hope was to achieve a more realistic view of what was going on in the home before the fact that I was asking questions about what was going on in the home was known by the parents, which might inform their activities. I wanted an idea of what they were voluntarily doing from the child's perspective before they were asked to list what they were doing themselves. 64% of the parents at A LOT responded to my request for a telephone interview compared to 7% of the parents at NOT MUCH. Several of the children at NOT MUCH told me the following week that their parent had thrown my letter away.

To record the information from the parent interviews, when a parent called and identified her/himself to me (or when I returned their call), I informed them that I wanted to put my phone on speaker and turn on my video camera to record the conversation so that I did not have to take up extra time by writing things down. Since I have only a cell phone, I carried it, my video camera, and a copy of the interview protocol around in my bag so that I did not have to be at home when a call arrived. I would find a quiet place, which more often than not was sitting in a parking lot in my car. Each night I used the tapes to fill in the interview protocol for the parent who had responded. Surprisingly, none of the parents declined my interview after being informed of the recording. This could be because they knew ahead of time what the questions were going to be, or it could be because it was their nature to be voluntary since they had responded to my request to call in the first place. I asked the questions in order, and then when I was finished, I asked them if they had anything further to add. Each recorded interview lasted about seven minutes.

Of the parents from NOT MUCH who responded, all three were the mother of the child (two girls and one boy). Each said that she had some college. Their average age was 33.7 years old. Each household had an average of 2.6 children in the house. One of the mothers was using flashcards, worksheets, and skip-counting with her daughter. The second mother was using flashcards and calling out the facts to her son. She wondered how much the teacher made her son study in class. She said that she had hoped he would find it easier than it was seeming to be. The third mother was allowing her daughter to use www.multiplication.com and was calling out the facts. This third mother asked me for suggestions to assist her daughter to memorize the answers. She also told me to please remember that parents and students need down time after work and school just like I did when I was off.   These parents did not seem to be aware of what the teachers' goals for the multiplication facts were for the year. They said that they wanted their child to learn then and be on par with their peers. I felt like these parents were willing to help their child, but they either didn't have a focused plan of action or they did very little or they didn't seem to know what to do. I coded this parent behavior as "school/home separate sphere," "accomplishment of natural growth," "logical practice," and "not much."

Of the parents from A LOT who responded, 84% were the mother and 16% were the father. All of the parents had college degrees, 55% having a bachelor's degree, 32% had a master's degree, and 13% had doctorate degrees. 31% of these parents were teachers. The average age of these parents was 39.2 years old. Each household had an average of 2.4 children, and four of the children whose parents responded were the only child in the household. The parent responses to what activities they were doing at home mirrored the children's previously obtained responses. As I had hoped, the mothers of both of the two girls who had been able to complete the multiplication quiz in under 7 minutes prior to "There's Nothing Spooky About Multiplication" responded. The mother of the black girl who had been the first to finish offered the richest conversation when she said she printed worksheets from a website and used a kitchen timer, but that her main resource was a “Learn Your Times Tables Kit”(Vorderman, 2006) she purchased while still in Australia and had brought to America with her. She said the kit contained five ways to learn. It had a say along CD, refrigerator magnets, a hidden answers game, a star reward chart, and a workbook. She said that they had used the kit 5 days a week. She had two younger children at home and planned to purchase another kit for each one. (She raved over this kit so much that I ordered one to look at.) There was one mother of a white boy who said she was using a kitchen timer at home, but she also told me that she did not believe in the concept of timed multiplication facts. She said that she did not believe it was important for all 3rd graders to know the facts in 5 minutes. She said it caused unnecessary anxiety. She was pleasant as she made these remarks and even thanked me for conducting the study. Each of the parents at A LOT who responded to my request for a telephone interview seemed very aware of the teachers’ goals for the learning of the multiplication pairs for the year, and each had a plan of action of their own to make sure their child was successful. I coded this parent behavior as “school/home intertwined,” “concerted cultivation,” “systematic support,” and “a lot.”

The following week I printed one last survey question on the back of the multiplication quiz (see Appendix F). Since the computer and access to the Internet seemed to be acting as a pedagogical resource in the home, I wanted to find out which children had access to this. At A LOT, 96% of the children had a computer at home and 92% also had Internet access. At NOT MUCH, 81% had a computer at home, but only 53% also had Internet access at home.

With the teacher, child, and parent interviews completed, I began to create payoff matrixes for the two schools. I coded those students whose parents had responded as “a lot” and those students whose parents had not responded as “not much” no matter which of the two schools they were in. I considered a student whose parent responded as having more pedagogical capital than a child whose parent did not respond. My justification was that just because a child attended a school that I considered to have not much pedagogical capital, this did not mean that child personally had little pedagogical capital. I based this reasoning on Gordon's relaying the story of the children in James Comers' little book, *Maggie's American Dream* (1989).

I wanted to show what a possible payoff matrix for the field of play for these two schools at the extremes of the socio-economic spectrum could possibly look like at the time of the two benchmarks in December and May which had been set as goals for timed mastery by the teachers at A LOT and general mastery by the teachers at NOT MUCH. According to Bourdieu, we enter a field of play at birth, so in this way a child who is born at either of these two ends of the spectrum would drop into the payoff matrix for either A LOT or NOT MUCH. Table 13 shows the set of 2-by-2 payoff matrixes for the average quiz scores in December, in which the children at A LOT were expected to have mastered the 100 multiplication facts.

Table 13

Payoff Matrixes for Average Quiz 9 Score in December

	A LOT			NOT MUCH	
	f[a]	dnf[b]		f[a]	dnf[b]
r[c]	98.7	86.0	r[c]	--	61.3
dnr[d]	98.4	85.0	dnr[d]	--	56.4

[a] student finished the quiz in under 7 minutes
[b] did not finish the quiz
[c] parent responded
[d] parent did not respond

The *fxr* and *fxdnr* positions were considered to be the most desirable payoffs in each matrix because they denoted that the child was able to complete the quiz in the time allotted. *fxr* was not considered to be necessarily better than *fxdnr* because the goal was for the child to finish the quiz by December, not for the parent to respond. The *dnfxr* position was the next most desirable payoff because it denoted that while the child was not able to finish the quiz, the parent at least responded which could be a sign of pedagogical capital particularly if the teacher was asking for support from the home. The *dnfxdnr* position was considered the least desirable payoff because the child would not have finished the quiz nor would the parent have responded. This could be a sign of a lack of pedagogical capital particularly if the teacher had asked for support from the home and none was forthcoming. The payoffs for quiz scores at A LOT for the four positions justify the labels of decreasing desirability applied to this case. There was no payoff in the *fxr* or *fxdnr* positions at NOT MUCH because no children were able to complete the quiz before Christmas. But also, completing the quiz before Christmas was not a goal at NOT MUCH. Again, the two remaining quiz score payoffs at NOT MUCH justify the labels of decreasing desirability.

Next, sets of 2-by-2 payoff matrixes were created for the final quiz given in May, at which time the children at both schools were expected to have mastered the 100 single digit facts. Table 14 shows the set of 2-by-2 payoffs matrixes for the two schools. Once again, the quiz score payoffs justify the labels of decreasing desirability.

Table 14

Payoff Matrixes for Average Quiz 18 Score in May

	A LOT			NOT MUCH	
	f[a]	dnf[b]		f[a]	dnf[b]
r[c]	99.5	88.0	r[c]	91.0	91.0
dnr[d]	99.8	--	dnr[d]	97.3	60.1

[a] student finished the quiz in under 7 minutes
[b] did not finish the quiz
[c] parent responded
[d] parent did not respond

Assuming that these are true quiz score payoffs matrixes for the four positions at each school, it was very enlightening toward the theory building process of the CGT to create matrixes which would show what percentage of each population received each payoff. As Bourdieu would say, all households "do not have the economic and cultural means for prolonging their children's education beyond the minimum necessary for the reproduction of the labor-power" (Bourdieu, 1986, p. 245) found in the home at the time of the child's rearing. What this means is, that while three of the four quiz score payoff positions at NOT MUCH are above 90, this does not mean that many of the children will receive these high payoffs from their year of schooling. I did not make a percentage payoff matrix for December, since only one school had that benchmark as a goal for mastery. Table 15 shows set of 2-by-2 matrixes for the children who fell into each payoff position at the time of the last quiz in May.

Table 15

Percentages of Children in each Payoff Position in May

	A LOT			NOT MUCH	
	f[a]	dnf[b]		f[a]	dnf[b]
r[c]	66.7	2.2	r[c]	6.7	3.4
dnr[d]	31.1		dnr[d]	23.3	66.7

[a] student finished the quiz in under 7 minutes
[b] did not finish the quiz
[c] parent responded
[d] parent did not respond

If it is true that *fxr* and *fxdnr* are the most desirable payoff positions in the matrix, and *dnfxdnr* is the least desirable, then by the end of 3rd grade, 97.8% of the children at A LOT would have received the two most desirable payoffs for their year of schooling and none would have received the least desirable payoff. On the other hand, 66.7% of the children at NOT MUCH would have received the least desirable payoff for their year of schooling, with only 30.0%

receiving the two most desirable payoff, which in this case was the goal of mastering the 100 single-digit multiplication facts by the end of 3rd grade.

Based upon all of the coding done on the data generated through the bi-weekly quizzing, survey questions, personal interviews, field notes, and answers to questions informed by the emerging data, CGT was used to create the following empirically based child, parent, and teacher concepts in the two categories (a lot and not much). Table 16 shows the child concepts listed by category.

Table 16

CGT: Child Concepts by Category

A LOT	NOT MUCH
Rapid, sharp increase in score	Slow, steady increase in score
Focused activities at home	Played after school
Developed automaticity	Exhibited adaptive compensation

Based upon the educational investment strategies that were occurring within the homes and schools … I'll call those strategies the group *habitus* … the two student populations displayed markedly different dispositions, *habitus,* and outcomes. If we really are, as Bourdieu so eloquently stated, dominated by yesterday's man, (Bourdieu, 1977), then the structural elements of the group *habitus* are the *lex insita* or underlying principle for the concepts eventually displayed by the children. They did not rear or teach themselves.

Tables 17 and 18 show the parent and teacher concepts listed by category.

Table 17

CGT: Parent Concepts by Category

A LOT	NOT MUCH
Focused activities at home	Random or no home activities
School/home intertwined	School/home separate spheres
Concerted cultivation	Accomplishment of natural growth

Table 18

CGT: Teacher Concepts by Category

A LOT	NOT MUCH
Set extra goals	Set minimum goals
Expected help from home	Expected little help from home
Concerted cultivation	Accomplishment of natural growth

The parent and teacher concepts are the key elements that formed a surprisingly coherent educational investment strategy. It seemed as though they were feeding on each other to form a loop of cultural logic of child rearing that mirrored the work of Annette Lareau in 2000 and 2003 where concerted cultivation accompanies an intertwined school and home and where the accomplishment of natural growth accompanies a separation of school and home. It is this combination of parent and teacher concepts that seems to foster the markedly different dispositions, *habitus,* and outcomes displayed by the children.

One final note about the teachers at A LOT; during the spring semester, all of the teachers at A LOT were taking part in a principal led book study. The book being used was "Failure is NOT an Option: Six Principles That Guide Student Achievement in High-Performing Schools" (Blankstein, 2004). The principal had purchased a copy of the book for each teacher at the school. Apparently, not participating in the book study was not an option either.

CHAPTER 5

CONCLUSION

Earlier, in the purpose for the study, I mentioned that Alabama has a long history of displaying underachievement in mathematics among its economically disadvantaged students. Alabama isn't alone, as this is an issue that strikes nearly every community both in the United States and abroad. Central to understanding this phenomenon, the term pedagogical capital was identified and legitimized as a subtype of cultural capital so that its effect as an unconscious privilege could be visualized. Prior to this research, the concept of pedagogical capital was a fuzzy quality that some students seemed to possess that enabled them to approach the academic table better positioned to benefit from the educational process than other children. For the child who had it, this quality acted nearly as a financial asset which justified the adoption of terms from both the provenances of education and economics. Thus theorized, it was time to discover whether pedagogical capital was real and if it had a real effect.

Three types of questions were used to guide the course of the research. The first question was quantitative in nature, and it produced deductive conclusions which were uniquely significant with regard to inferential testing. The second question was qualitative in nature, although grounded in empirical data, and it produced strong inductive conclusions that were the strongest indicators that helped to firmly ground the theory. The last question addressed issues of equity and social justice. Returning to them, the following questions guided this empirical and qualitative research:

1. Is there any empirical evidence that would show that the mathematics curriculum has areas of privilege for those with pedagogical capital over those without it; for instance, are there any elements in the *Alabama Course of Study: Mathematics* where children in possession of pedagogical capital thrive while their peers who do not possess adequate pedagogical capital struggle to or fail to demonstrate scholastic success in mathematics?

Even though the students at A LOT were thriving prior to the introduction of multiplication for the year when compared with their peers at NOT MUCH as the two-sample *t*-tests for quizzes 1 through 5 in Table 8 show, it was the rapid change from homogenous groups to non-homogenous groups that occurred between the two schools from quiz 5 to quiz 7 after "There's Nothing Spooky About Multiplication" that gave the most significant indication that the students at A LOT were in possession of a resource that seemed to be missing at NOT MUCH. In a style similar to the differences in the way money was raised for their major fund raising projects for the year, where the parents at A LOT raised $214,575 and the parents at NOT MUCH raised $3,670, not only were the fund raising and academic goals vastly different at the two schools, but the community that supported A LOT demonstrated being in possession of the resources needed to accomplish both goals. In the case of quickly raising a large sum of money, the community supporting A LOT was in possession of a lot of economic capital to donate toward the goal, whereas the community supporting NOT MUCH was not. In the case of quickly learning the single digit multiplication pairs, the community supporting A LOT was in possession of more pedagogical capital to apply toward the goal, whereas the community supporting NOT MUCH had less.

As the school year progressed, the students at NOT MUCH made some progress toward mastery of the 100 single-digit multiplication pairs, but nowhere near the progress made by the students at A LOT. As shown in Table 9, the use of the academic content knowledge levels as indicators show how much mastery the children had attained by each of the 18 quizzes given during the year. The *Alabama Course of Study: Mathematics* states that by the end of 3^{rd} grade, students should be able to apply basic multiplication facts through 9x9, or all of the single digit pairs (Alabama Department of Education, 2003). In this study, by the end of the school year, 53.3% of the children at NOT MUCH could still not recall nor could they use “adaptive compensation” techniques to derive answers for more than 80 out of the 100 of the single-digit multiplication facts. Compare this with A LOT where, by the last quiz, 100% of the children could recall at least 80 of the 100 facts. The children at A LOT were clearly thriving while their peers at NOT MUCH were still struggling.

While not an *Alabama Course of Study: Mathematics* (Alabama Department of Education, 2003) requirement for either school, the speed with which the children at A LOT were able to complete the 100 facts offered another shadow of evidence that the children at A LOT were in possession of more pedagogical capital than the children at NOT MUCH. As shown in Table 10, the speed of “automaticity” exhibited at A LOT, when compared to the slow struggles using “adaptive compensation” exhibited at NOT MUCH also began to become apparent soon after “There’s Nothing Spooky About Multiplication.”

A case could be made that the community supporting NOT MUCH had not been asked to donate the same amounts of money or to apply the same efforts to assist the children to quickly learn the single-digit multiplication pairs by a time limit, but recall in the qualitative analysis that these goals had been set by the teachers and parents at A LOT. The teachers and parents at NOT

MUCH had the same opportunity to set identical goals and they did not do so. Communities and individuals rarely set goals that are not attainable.

It is a conclusion of this research that the ability of the teachers at A LOT to set different goals and to deviate from the scripted scope and sequence was made possible due to the availability of pedagogical capital in the homes of their students. This same availability of pedagogical capital made it possible for the students at A LOT to thrive with regard to this element of the *Alabama Course of Study: Mathematics* while their peers at NOT MUCH were overwhelmingly still struggling at the end of the 3rd grade school year. This research was meant to highlight this type of disparity.

2. Can the term pedagogical capital, as an unconscious privilege possessed by some students and as an ideology in its own right, which is being advanced for general vocabulary usage, offer a compelling qualitative interpretation for some scholastic success in mathematics?

It is possible to make the argument that it may have been the difference in approach to the way multiplication was introduced at the two schools that accounts for the rapid change from homogenous groups to non-homogenous groups that occurred in this study rather than from the effect of pedagogical capital. However, using Bourdieuian fields of play by way of 2-by-2 payoff matrixes, it was shown through the administration of single-digit multiplication quizzes, along with teacher, parent and student interviews, and classroom observations during an entire school year, that this fuzzy quality could be quantified and visualized in Tables 13, 14, and 15. As an "irresistible analogy" (Bourdieu, 1980, p. 200), the availability of pedagogical capital at A LOT and the lack of it at NOT MUCH offers the most accurate account of how child, parent, and teacher concepts found at the two schools emerged during the course of this research. Those concepts are listed in Tables 16, 17, and 18. These concepts, empirically based in CGT, lead to the conclusion that pedagogical capital is a subtype of cultural capital which has now been identified and legitimized. Working as a triad, the teachers, parents and students at A LOT seemed to have a real philosophy, "This is what we're doing and this why we're doing it" … and then they reiterated this philosophy, "This IS what we're doing!" And they did it. Pedagogical capital is an unconscious privilege possessed by some children that offers a compelling interpretation for some of their success in mathematics.

3. Would this privilege be in keeping with the equity principle as outlined by the National Council of Teachers of Mathematics in their *Principles and Standards for School Mathematics*?

As mentioned in the theoretical framework, the NCTM has equity as its first guiding principle as a part of "making the vision of the *Principles and Standards* … a reality for all students" (NCTM, 2000, p. 12). Specifically mentioned in this equity principle are high expectations for all students (not just some), accommodating differences for students who may have special needs, and enabling and providing a significant allocation of human and material resources. Also, as mentioned in the literature review, the NCTM doggedly focuses on curriculum in a way that excludes experiences outside of the classroom. The *Principles and Standards* do not seem to have been designed to combat Lareau's unequal childhoods nor does it try to address concerns about those students with below average pedagogical capital, or one could say those children without a home advantage.

Principles and Standards reflects the input and the influence of many different sources. According to the authors, "educational research serves as the basis for many of the proposals and claims made throughout this document about what is *possible* for students to learn about certain content areas at certain levels" (NCTM, 2000, p. xii, emphasis added). As far as the mastery of the single-digit multiplication facts by the end of 3rd grade, this research has certainly documented that it is "possible" … yet, depending upon the field of play a child enters at birth, this research has also documented that while mastery is possible, it is not always probable.

By its own pen, *Principles and Standards* is a document intended to set goals, to serve as a resource, to guide in the development of curriculum frameworks, and to act as a gadfly to stimulate conversation about how best to provide a deep understanding of mathematics (NCTM, 2000). Hopefully, this research on pedagogical capital will breathe new life into that gadfly. It is a conclusion of this study that much research has been done using a Bourdieuian analysis since the writing of the *Principles and Standards* that may have informed the authors at that time had it been available to them. It is another conclusion that this unconscious privilege made possible by pedagogical capital would not be in keeping with a fresher equity principle. Perhaps it is time for the NCTM to consider picking up its pen again.

I can only imagine the implications of this research. I will admit now that it was my oldest daughter who used the term flower-works for fireworks. The term never made it past her lips or out of her baby book until I mentioned it in this research. The same may be true for the term pedagogical capital. That being said, from my own experiences as a teacher, I know that NOT MUCH does not equal not bright. One never knows where the person with the ability to find the next needle in our haystack will come from, but if the wall is too hard for that student to climb or if that student enters a field of play at birth where the probability of success is very low, we may all lose and never know it. What began as an analogy to a rock climbing wall on a field trip turned into a field of play analogy with idealized payoff matrixes that mimic those sections of the wall with judiciously-placed (easy) hand- and footholds and those sections with sparsely-placed (hard) hand- and footholds. The rock wall is still a good analogy for pedagogical capital even though I transitioned from it to a matrix. It's easier to understand how a wall is hard to climb than to visualize a field with a big payoff that is not easily attainable. Actually, I don't think my students thought I could climb any of the walls at all, much less all three of them. When I spoke to Dr. Gordon in 2005, I wasn't sure that I could pull the fence away from achievement gaps created by race, gender, or other easily measured socio-economic measures alone, but it is my hope that at least one implication of this research will be that the fence will now include pedagogical capital as a subtype of cultural capital.

Another implication that began to occur to me during the course of the research is that there seemed to be some resources on the Internet that the children at both schools said they found helpful. I began to consider how the Internet could act as "virtual pedagogical capital" for a child who may be isolated from actual pedagogical capital or as a resource for parents who want to help but don't seem to know what to do. When I looked at a few of the websites that the children were using, I began to wonder what constituted a well-laid out website from the perspective of the child bearing in mind the academic goals of the school. Rather than a teacher filling a class website willy-nilly with a plethora of websites that may be mildly helpful at best, perhaps some new web-based products could be developed or existing ones revised to be made more effective and efficient. During the course of this research, I began to create one myself at www.learnthetimestables.com. Rather than have a lot of advertisements to sell a questionable assortment of educational products, it is my goal to offer sound research in very understandable language, along with links to websites that have an empirically based reason for their inclusion. I believe that research informed, web-based products geared specifically toward areas of the mathematics curriculum where the achievement of children from differing walks of life historically begins to diverge would be of great value. A caveat, though: since it is more often than not the students and teachers at schools like NOT MUCH who have little pedagogical capital or economic capital who may be most in need of these products, there should be no cost to the school, teacher, or child.

Yet another implication of this research is due to the low evidence of skip-counting or understanding of the repeated nature of multiplication that was exhibited by the children at NOT MUCH at the beginning of this study. I believe it would be helpful to replicate this study in a more longitudinal manner, picking up children for the study near the end of their 2nd grade year and following them through the completion of their 4th grade year to see what is really possible and probable like I did with the 3rd grade in isolation. Assuming that the 5s are solved by reference to a skip-count rule that each multiple of 5 may only end in 5 or 0, and with a similar skip-count rule for the 2s where the multiples end in 2, 4, 6, 8, 0, perhaps more emphasis should be placed on skip-counting in the grades leading up to the introduction of multiplication because this behavior also made the child a candidate for early "adaptive compensation."

A final implication of this study would be to research more about the intersection of mathematics as a language acquisition process and some of the emerging theories in early literacy and second language acquisition. This was particularly brought home during this research with the teacher at A LOT's borrowing and the subsequent use of the term "automaticity." If mathematics is considered to be a language, then there may be places where a variety of these theories are possibly different aspects of the same theme. It may be possible for the different schools of thoughts to lift each other as they rise.

In conclusion, capital is the reason why not all scenarios are equally possible. As shown in this research, the availability of pedagogical capital can create very different payoff matrixes depending upon the field of play that the child enters at birth. Relational studies have seldom been incorporated into the field of play of the social sciences because they are often very difficult to show objectively. As such, research in the area of parental involvement had been chaotic and fragmented. What seems to have been lacking was empirical research that was conducted with the benefit of an empirically grounded theoretical framework. As the shadows surrounding the rhetoric that no child should be left behind begin to lengthen and fade, it is hoped that the shadow newly cast by pedagogical capital will remain crisply pointing to the time when all students began to be provided the opportunity of its shade, not just the lucky few.

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APPENDIX A

TEACHER INTERVIEW PROTOCOL

The following questions will be asked of the classroom teacher at the beginning of the school year:

1. What is your name?

2. What is your age?

3. What is the highest degree you hold?

4. How long have you been teaching school?

5. How long have you been a teacher here? History?

6. Describe the students you have typically had in the past.

7. Have there been any major demographic shifts?

8. Describe the students you expect to have this year.

9. Describe your expectations for your student's learning multiplication pairs this year.

10. Do you foresee any complications with regard to meeting your expectations?

11. Is there any other information you would like to add?

APPENDIX B

PARENT INTERVIEW PROTOCOL

The following questions will be asked of the parent after the introduction of the multiplication pairs:

1. What is your name?
2. What is your age?
3. What is your highest level of education?
4. Have you ever been a schoolteacher?
5. How long?
6. Which subject/grade?
7. Why did you stop teaching school?
8. Describe the students in your child's class.
9. Describe your expectations for your child's learning of multiplication pairs this year.
10. Did you foresee any complications with regard to meeting your expectations?
11. Have you engaged in any special activities to assist your child? Please describe.
12. Are there any other children in the home?
13. Ages? Genders?
14. Is there any other information you would like to add?

APPENDIX C

3rd GRADE MULTIPLICATION PAIR QUIZ

To create this quiz, the multiplication pairs from 0x0 to 9x9 were written on index cards. Cards were shuffled ten times and then drawn out one at a time to place in the quiz. The quiz was created using an Excel spreadsheet. The five versions of the quiz were obtained by switching the order of the columns. The following is the multiplication pair test for 3rd graders:

First Name: ____________________ Last Name: ____________________

1

8 x 9 =	5 x 1 =	0 x 9 =	1 x 8 =	4 x 8 =
0 x 4 =	4 x 3 =	3 x 7 =	5 x 7 =	0 x 6 =
5 x 4 =	7 x 0 =	2 x 5 =	8 x 6 =	8 x 2 =
6 x 2 =	2 x 4 =	3 x 6 =	3 x 4 =	0 x 5 =
2 x 9 =	7 x 1 =	2 x 1 =	8 x 5 =	6 x 6 =
4 x 2 =	0 x 0 =	6 x 8 =	3 x 3 =	8 x 1 =
9 x 5 =	7 x 6 =	2 x 0 =	7 x 3 =	6 x 5 =
4 x 1 =	5 x 8 =	6 x 7 =	8 x 0 =	1 x 2 =
1 x 3 =	7 x 5 =	1 x 9 =	7 x 2 =	5 x 5 =
9 x 4 =	5 x 3 =	8 x 4 =	4 x 7 =	1 x 7 =
1 x 4 =	9 x 0 =	7 x 4 =	9 x 9 =	7 x 9 =
2 x 8 =	9 x 8 =	8 x 3 =	4 x 6 =	1 x 6 =
9 x 3 =	8 x 7 =	9 x 2 =	9 x 7 =	5 x 6 =
4 x 4 =	1 x 1 =	0 x 8 =	2 x 3 =	3 x 2 =
5 x 2 =	1 x 0 =	9 x 1 =	9 x 6 =	1 x 5 =
0 x 1 =	6 x 9 =	0 x 7 =	6 x 3 =	3 x 1 =
4 x 0 =	2 x 6 =	4 x 9 =	2 x 2 =	7 x 8 =
3 x 9 =	6 x 1 =	5 x 0 =	0 x 3 =	3 x 0 =
2 x 7 =	6 x 0 =	3 x 5 =	8 x 8 =	7 x 7 =
3 x 8 =	5 x 9 =	4 x 5 =	0 x 2 =	6 x 4 =

First Name: ______________________ Last Name: ______________________

2

4 x 8 =	8 x 9 =	5 x 1 =	0 x 9 =	1 x 8 =
0 x 6 =	0 x 4 =	4 x 3 =	3 x 7 =	5 x 7 =
8 x 2 =	5 x 4 =	7 x 0 =	2 x 5 =	8 x 6 =
0 x 5 =	6 x 2 =	2 x 4 =	3 x 6 =	3 x 4 =
6 x 6 =	2 x 9 =	7 x 1 =	2 x 1 =	8 x 5 =
8 x 1 =	4 x 2 =	0 x 0 =	6 x 8 =	3 x 3 =
6 x 5 =	9 x 5 =	7 x 6 =	2 x 0 =	7 x 3 =
1 x 2 =	4 x 1 =	5 x 8 =	6 x 7 =	8 x 0 =
5 x 5 =	1 x 3 =	7 x 5 =	1 x 9 =	7 x 2 =
1 x 7 =	9 x 4 =	5 x 3 =	8 x 4 =	4 x 7 =
7 x 9 =	1 x 4 =	9 x 0 =	7 x 4 =	9 x 9 =
1 x 6 =	2 x 8 =	9 x 8 =	8 x 3 =	4 x 6 =
5 x 6 =	9 x 3 =	8 x 7 =	9 x 2 =	9 x 7 =
3 x 2 =	4 x 4 =	1 x 1 =	0 x 8 =	2 x 3 =
1 x 5 =	5 x 2 =	1 x 0 =	9 x 1 =	9 x 6 =
3 x 1 =	0 x 1 =	6 x 9 =	0 x 7 =	6 x 3 =
7 x 8 =	4 x 0 =	2 x 6 =	4 x 9 =	2 x 2 =
3 x 0 =	3 x 9 =	6 x 1 =	5 x 0 =	0 x 3 =
7 x 7 =	2 x 7 =	6 x 0 =	3 x 5 =	8 x 8 =
6 x 4 =	3 x 8 =	5 x 9 =	4 x 5 =	0 x 2 =

First Name: ______________________ Last Name: ______________________

3

1 x 8 =	4 x 8 =	8 x 9 =	5 x 1 =	0 x 9 =
5 x 7 =	0 x 6 =	0 x 4 =	4 x 3 =	3 x 7 =
8 x 6 =	8 x 2 =	5 x 4 =	7 x 0 =	2 x 5 =
3 x 4 =	0 x 5 =	6 x 2 =	2 x 4 =	3 x 6 =
8 x 5 =	6 x 6 =	2 x 9 =	7 x 1 =	2 x 1 =
3 x 3 =	8 x 1 =	4 x 2 =	0 x 0 =	6 x 8 =
7 x 3 =	6 x 5 =	9 x 5 =	7 x 6 =	2 x 0 =
8 x 0 =	1 x 2 =	4 x 1 =	5 x 8 =	6 x 7 =
7 x 2 =	5 x 5 =	1 x 3 =	7 x 5 =	1 x 9 =
4 x 7 =	1 x 7 =	9 x 4 =	5 x 3 =	8 x 4 =
9 x 9 =	7 x 9 =	1 x 4 =	9 x 0 =	7 x 4 =
4 x 6 =	1 x 6 =	2 x 8 =	9 x 8 =	8 x 3 =
9 x 7 =	5 x 6 =	9 x 3 =	8 x 7 =	9 x 2 =
2 x 3 =	3 x 2 =	4 x 4 =	1 x 1 =	0 x 8 =
9 x 6 =	1 x 5 =	5 x 2 =	1 x 0 =	9 x 1 =
6 x 3 =	3 x 1 =	0 x 1 =	6 x 9 =	0 x 7 =
2 x 2 =	7 x 8 =	4 x 0 =	2 x 6 =	4 x 9 =
0 x 3 =	3 x 0 =	3 x 9 =	6 x 1 =	5 x 0 =
8 x 8 =	7 x 7 =	2 x 7 =	6 x 0 =	3 x 5 =
0 x 2 =	6 x 4 =	3 x 8 =	5 x 9 =	4 x 5 =

First Name: ____________________________ Last Name: ____________________________

4

0 x 9 =	1 x 8 =	4 x 8 =	8 x 9 =	5 x 1 =
3 x 7 =	5 x 7 =	0 x 6 =	0 x 4 =	4 x 3 =
2 x 5 =	8 x 6 =	8 x 2 =	5 x 4 =	7 x 0 =
3 x 6 =	3 x 4 =	0 x 5 =	6 x 2 =	2 x 4 =
2 x 1 =	8 x 5 =	6 x 6 =	2 x 9 =	7 x 1 =
6 x 8 =	3 x 3 =	8 x 1 =	4 x 2 =	0 x 0 =
2 x 0 =	7 x 3 =	6 x 5 =	9 x 5 =	7 x 6 =
6 x 7 =	8 x 0 =	1 x 2 =	4 x 1 =	5 x 8 =
1 x 9 =	7 x 2 =	5 x 5 =	1 x 3 =	7 x 5 =
8 x 4 =	4 x 7 =	1 x 7 =	9 x 4 =	5 x 3 =
7 x 4 =	9 x 9 =	7 x 9 =	1 x 4 =	9 x 0 =
8 x 3 =	4 x 6 =	1 x 6 =	2 x 8 =	9 x 8 =
9 x 2 =	9 x 7 =	5 x 6 =	9 x 3 =	8 x 7 =
0 x 8 =	2 x 3 =	3 x 2 =	4 x 4 =	1 x 1 =
9 x 1 =	9 x 6 =	1 x 5 =	5 x 2 =	1 x 0 =
0 x 7 =	6 x 3 =	3 x 1 =	0 x 1 =	6 x 9 =
4 x 9 =	2 x 2 =	7 x 8 =	4 x 0 =	2 x 6 =
5 x 0 =	0 x 3 =	3 x 0 =	3 x 9 =	6 x 1 =
3 x 5 =	8 x 8 =	7 x 7 =	2 x 7 =	6 x 0 =
4 x 5 =	0 x 2 =	6 x 4 =	3 x 8 =	5 x 9 =

First Name: ______________________________ Last Name: ______________________________

5

5 x 1 =	0 x 9 =	1 x 8 =	4 x 8 =	8 x 9 =
4 x 3 =	3 x 7 =	5 x 7 =	0 x 6 =	0 x 4 =
7 x 0 =	2 x 5 =	8 x 6 =	8 x 2 =	5 x 4 =
2 x 4 =	3 x 6 =	3 x 4 =	0 x 5 =	6 x 2 =
7 x 1 =	2 x 1 =	8 x 5 =	6 x 6 =	2 x 9 =
0 x 0 =	6 x 8 =	3 x 3 =	8 x 1 =	4 x 2 =
7 x 6 =	2 x 0 =	7 x 3 =	6 x 5 =	9 x 5 =
5 x 8 =	6 x 7 =	8 x 0 =	1 x 2 =	4 x 1 =
7 x 5 =	1 x 9 =	7 x 2 =	5 x 5 =	1 x 3 =
5 x 3 =	8 x 4 =	4 x 7 =	1 x 7 =	9 x 4 =
9 x 0 =	7 x 4 =	9 x 9 =	7 x 9 =	1 x 4 =
9 x 8 =	8 x 3 =	4 x 6 =	1 x 6 =	2 x 8 =
8 x 7 =	9 x 2 =	9 x 7 =	5 x 6 =	9 x 3 =
1 x 1 =	0 x 8 =	2 x 3 =	3 x 2 =	4 x 4 =
1 x 0 =	9 x 1 =	9 x 6 =	1 x 5 =	5 x 2 =
6 x 9 =	0 x 7 =	6 x 3 =	3 x 1 =	0 x 1 =
2 x 6 =	4 x 9 =	2 x 2 =	7 x 8 =	4 x 0 =
6 x 1 =	5 x 0 =	0 x 3 =	3 x 0 =	3 x 9 =
6 x 0 =	3 x 5 =	8 x 8 =	7 x 7 =	2 x 7 =
5 x 9 =	4 x 5 =	0 x 2 =	6 x 4 =	3 x 8 =

APPENDIX D

1st CHILD SURVEY

The following survey was printed on the back of the multiplication quiz for use on first the week after the introduction of the multiplication pairs.

MULTIPLICATION FACT STUDY

What kinds of things did you do to learn your multiplication facts this past week?

- O I forgot to study at home
- O multiplication.com
- O studyisland.com
- O flashcards
- O worksheets
- O used a kitchen timer
- O count on my fingers
- O skip count by 2's, 3's, 5's, etc.
- O Nines "trick"
- O ___________________________________
- O ___________________________________
- O ___________________________________
- O ___________________________________
- O ___________________________________

Circle the thing that helped you the MOST

APPENDIX E

2nd CHILD SURVEY

The following survey was printed on the back of the multiplication quiz for use on the second week after the introduction of the multiplication pairs.

MULTIPLICATION FACT STUDY

Who helped you with multiplication this week?

- ○ I forgot to study at home
- ○ I studied by myself
- ○ My teacher
- ○ My mom
- ○ My dad
- ○ Older sister
- ○ Older brother
- ○ ___________________________________
- ○ ___________________________________
- ○ ___________________________________
- ○ ___________________________________

Circle the one who helped you the MOST

APPENDIX F

3rd CHILD SURVEY

The following survey was printed on the back of the multiplication quiz for use on the third week after the introduction of the multiplication pairs.

MULTIPLICATION FACT STUDY

Circle one

I have a computer at home

Yes No

I have internet at home

Yes No