

Education Policy and the Mathematics Curriculum
in New York City Middle Schools,
1958 to 2002

by
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A dissertation submitted to the Graduate Faculty in Urban Education in partial fulfillment
of the requirements for the degree of Doctor of Philosophy, The City University of New York

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Graduate Faculty in Urban Education in satisfaction of the
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ABSTRACT

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Advisor: Professor Kenneth Gold

This study investigates how mathematics education policy and curriculum in New York City changed over the period from 1958 through 2002. It looks at the events leading up to the “new math” era, the “back to basics” movement, and the Standards movement initiated by the National Council of Teachers of Mathematics (NCTM) in 1989. Since this period is bounded by two important pieces of legislation, the National Defense Education Act (NDEA), 1958, and the No Child Left Behind Act (NCLB) 2001 an assessment of the arguments for and against the federal intervention in education is essential.

The research methodology used for this study is the investigation and analysis of primary sources and secondary data. The primary sources consisted of archival data containing records of mathematics education policy decisions, reports of meetings of officials of the New York City Department of Education, and curricula reforms over the last fifty years. The secondary sources of data came from previous mathematics education studies in the research community, including national studies that had selected New York City as a local site. Also, major pieces of relevant scholarly work on mathematics education were consulted.

After a thorough review of the relevant literature and a careful study of the data obtained from the various source documents, it could be argued that notwithstanding the best efforts of many chancellors: a) the decline of the mathematics scores as students move from the elementary

to the middle grades was never fundamentally better; b) the overall mathematics scores in grades 3 through 8 are still unsatisfactory; c) the achievement gap between students in poor neighborhoods and their more affluent counterparts is still cause for concern; and, d) there is still a persistent shortage of mathematics teachers in New York City schools. I further argue that since these problems have defied all attempts to solve them under the present system, it is obvious that a more concerted effort need to be made to understand the reason for these failures in the interest of the city's children.

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CHAPTER ONE

REASON FOR STUDY

It has been claimed by some authorities that “The purpose of historical research is knowledge production, learning that is politically situated and made useful for the transformation of culture and society.”¹ On the other hand some critics assert that history has been the subject of intense debate and controversy and as a result its nature and purpose are continually open to question.² Nevertheless there is no arguing that historical research is undertaken for a specific purpose, whatever that may be. Most historical studies are done for the purpose of understanding. In this case the purpose of this study is to better understand the history of mathematics education policy and curriculum in New York City in the period 1958 through 2002. It is hoped that a better understanding of the past will help contextualize current discussion of curriculum and policy.

Mathematics is a powerful tool and its knowledge propels those who possess it to positions of power and authority. Those who are without that knowledge are usually relegated to menial positions. Moses and Cobb believe that math literacy is the key to the future of disenfranchised communities.³ Other writers share similar sentiments. Danny Martin says that he agrees with those who conceptualize mathematics as a gatekeeper and also with those who

1. Leila A. Villaverde, Joe L. Kincheloe, and Frances Helyar, “Historical Research in Education,” in *Doing Educational Research*, eds. K. Tobin and J. Kincheloe (Rotterdam: Sense Publishers, 2006), 317.

2. William J. Reese, “Bearing Witness on the Nature and Purpose of History,” in *A History of School Mathematics*, eds. George M. A. Stanic and Jeremy Kilpatrick, (Reston, VA: NCTM 2003), 5.

3. Robert P. Moses and Charles E. Cobb, *Radical Equations Civil Rights from Mississippi to the Algebra Project*, (Boston: Beacon Press 2001), 5

identify math literacy as a new form of civil rights.⁴ It has also been said that mathematics is one of the keys to leadership in our information-based technological society.⁵

It could be suggested, therefore, that mathematics education confers agency to the people who are fortunate to receive it. Schoenfeld says that a lack of mathematical competence and credentials creates a barrier to full participation in the economic mainstream. He continues, “Hence differential participation and success rates in mathematics become an issue of social justice.”⁶ However, the issue of social justice has not featured prominently in mathematics education policy, even though some educators have argued over the years that it is an important issue. For example, Michelli says “Most teacher educators I know believe that education policy should be grounded first in moral arguments with a focus on democratic practice and social justice and in educational arguments that lead to high level understanding and the ability to think critically.”⁷

This dissertation looks at the history of middle school⁸ mathematics education policy in New York City against the backdrop of the federal intervention in education during the period 1958 to 2002. Middle schools were selected for study because they have been considered “the

4. Danny Bernard Martin, “Hidden Assumptions and Unaddressed Questions in Mathematics for All Rhetoric,” *The Mathematics Educator*, 13, no. 2 (2003), 7-21.

5. Report of the Chancellor’s Working Group on Mathematics Education, “Mathematics Education in New York City What It Is And What It Should Be,” New York City Board of Education, June, 1990, New York City Municipal Archives, Series 345, Box 11, Folder 117.

6. A. Schoenfeld, “Looking For Leverage: Issues Of Classroom Research On “Algebra For All,”” Paper presented at the 2nd International Conference on the Teaching of Mathematics, Crete, July 2002, 3.

7. Nicholas Michelli, “The Politics of Teacher Education: Lessons from New York City,” *Journal of Teacher Education*, 56, (2005) 235.

8. The term middle school is used in this dissertation to include both intermediate schools (grades 6-8) and junior high schools (grades 7-9).

intractable problem of public schools nationwide.”⁹ Middle schools, especially those in urban areas, have had a troubled history. They seem to be burdened with more than their share of school difficulties. As Noguera and Quinn observe “all too often, middle schools with the greatest challenges and longest history of academic difficulty have been staffed by the least experienced educators and populated by the most disadvantaged students. Additionally, many of the middle-grade schools serving the lowest achieving students have been overcrowded, have had difficulty maintaining order and safety, and have been poorly maintained physically. The combination of sub-optimal conditions is one of the greatest obstacles to sustained gains in student achievement.”¹⁰ A major obstacle to sustained gains in student achievement is the high percentage of untrained and unqualified mathematics teachers (discussed in Chapter 3) in the schools.

The study, therefore, tries to make sense of the various policy changes that took place with a view to eliminating some of these problems. It is an attempt to understand what effect the various policy changes had on mathematics education in New York City. I have looked at influential literature on the “new math” movement, the “back to basics” movement, and the standards movement. In addition, I will discuss the perennial mathematics teacher shortage, as this is important to the mathematics education policy in New York City.¹¹

Most importantly, I will examine the role of the federal government in education to see what impact this had on mathematics education policy and curriculum in the city. Chapter 2 will deal with this very critical aspect of education history during the period, commencing with the

9. Robert Noguera and Christian C. Quinn, “Report of the New York City Council Middle School Task Force,” New York City Council, 2007.

10. Noguera and Quinn, Report of the New York City Council Middle School Task Force, 2007, 6.

11. Jerome Bruner, *The Culture of Education*, (Cambridge: Harvard University Press, 1996), 66

administration of President Dwight Eisenhower and ending with that of President George W. Bush. The exceptional accomplishment achieved by President Johnson when he was able to obtain the passage of the Elementary and Secondary Education Act (ESEA) 1965 will be thoroughly analyzed. The political and social milieu prevailing at the time will be elaborated on in an effort to explain why President Kennedy failed and President Johnson succeeded.

It is necessary in a study like this to investigate whether the middle school mathematics education policy in New York City has advantaged some and disadvantaged others. This topic is relevant because the ESEA was designed to bring some comfort to the underprivileged. Further, it is important to see if the disadvantaged groups which had been of some concern to President Johnson in the mid-1960s benefited from his largesse. It is necessary, therefore, for historians of middle school mathematics education who are studying urban school systems to understand the social problems which affect those students and which help to perpetuate their history of mediocre performance.

The purpose of this dissertation is not so much to establish truth, but to find a reasonable explanation based on evidence for the causes of the problems which plagued mathematics education in New York City over the years. An understanding of such questions will most certainly lead to a better understanding of the history of middle school mathematics education in New York City. In Chapter 3 I will briefly scrutinize Post-War mathematics education in New York City, and then I will take up the efforts of the curriculum development division of the New York City Board of Education in 1958 through 1975. This was the “new math” era during which time many mathematics educators were clamoring for change.

I cannot say with certainty that this study will lead to the truth because truth is a social construction. In this respect Bruner suggested that antinomies remind us that truths do not exist

independently of the perspectives of those who hold them to be so.¹² He further raised the question of who owns the right version of history.¹³ Of course any individual's version of history is based on that individual's way of thinking, one's way of constructing meaning—in short, one's way of interpreting the world. As a result we come to the realization that history is at times subjective. It is safe to say then, that this history of middle school mathematics education policy and curriculum in New York City falls under these same considerations.

As a former middle school teacher in New York City I believe that it is necessary to examine the thinking, beliefs, and aims which drove the policies in middle school mathematics education in New York City. I am concerned because these policies appear to have been unable to bring about any measure of success in addressing the decline in mathematics scores in the middle grades, in reducing the school dropout rate, in significantly closing the achievement gap, and in making any visible impact on the overall low scores on the standardized tests.

It may be that the purpose of mathematics in the middle school curriculum has not been clearly defined so that policy-makers are not sure exactly what the end product should be. A clear definition of its purpose would help tremendously in formulating and implementing a firm policy on mathematics education in New York City middle schools. Before one may be able to properly formulate policy, the purpose of mathematics in the middle school curriculum must be first determined. Bruner believes that one purpose of education is to enable the students “to operate at their fullest potential, to equip them with the tools and the sense of opportunity to use their wits, skills, and passions to the fullest.”¹⁴

12. Jerome Bruner, *The Culture of Education*, (Cambridge: Harvard University Press, 1996), 66.

13. Bruner, *The Culture of Education*, 68.

14. Bruner, *The Culture of Education*, 67.

The fact that the determination of the purpose of mathematics education was so elusive created a problem for curriculum developers. Hence the much vaunted “new math” (discussed in Chapter 3) was rejected by many mathematics educators and parents. This led to the call for “back to basics” in the early 1970s. This back to basics movement will be discussed in Chapter 4, which examines the middle school mathematics education in the city in 1972 through 1988. The analysis scrutinizes the major events which impacted the education of the children—the austerity programs, the teacher shortage, and the changes in the standardized tests.

The period 1985 through 2002 will be discussed in Chapter 5. This was the period of the standards movement led by the National Council of Teachers of Mathematics (NCTM). The council re-asserted its leadership role in the mathematics education community in 1989 when it published its ground breaking *Curriculum and Evaluation Standards for School Mathematics*. So compelling was this publication that states and other local education authorities used it as a guide to develop their own standards.

Also discussed in Chapter 5 is the reauthorization by President George Bush of the ESEA in the form of the No Child Left Behind Act (NCLB) 2001. This new law for the first time linked federal funding in education with a demand for responsibility and accountability by the states. Schools, teachers and students faced serious consequences if they failed to meet the requirements of the NCLB. The expectation was that all of the problems in the New York City middle school which were identified above could be resolved as a result of this new education policy by the federal government

Because of my worldview¹⁵ I see the problems encountered in middle school mathematics education in New York City to be the result of the political, social, and economic conditions which existed during the period. In this regard I deem Jean Anyon's work¹⁶ most instructive. She shows how job, wage, tax, transportation, and housing policies maintain minority poverty in urban neighborhoods, which in turn affect the educational potential of the unfortunate victims. These conditions serve as a backdrop against which the investigation will take place. To ignore these conditions is tantamount to investigating in a vacuum. I argue, therefore, that in any effort to understand fully the history, it is important to examine the political and social forces that framed the various reforms, and the intentions that brought about the curricular changes in New York City middle school mathematics education over the last fifty years. Only then will a reasonable explanation be obtained.

15. I grew up in a rural, impoverished Caribbean community and I believe that I see everything through those lens.

16. Jean Anyon, "What "counts" as educational policy? Notes toward a new paradigm," *Harvard Educational Review*, 75, no.1, (2005); 65-88.

CHAPTER TWO

INTRODUCTION

“While American schoolchildren were learning how to get along with their peers or how to bake a cherry pie, so the explanation went, Soviet children were being steeped in the hard sciences and mathematics needed to win the technological race that had become the centerpiece of the cold war.”¹

“We have a genuine national crisis. More and more we are divided into two nations. One that reads, one that doesn’t; one that dreams, one that doesn’t.”²

In this chapter I consider a period when there were two major external developments in public education that had a profound effect on middle school mathematics in New York City. The first issue was the intervention in education by the federal government. This was strongly opposed by many who cited the Tenth Amendment as one of the most important reasons for their opposition. However these objections were sufficiently quieted to allow the passage of the NDEA in 1958 and the ESEA in 1965. Therefore any discussion of federal intervention would be incomplete if the effects of these extremely important and far reaching pieces of legislation were not examined.

I also examine the legislative approach to education by the various presidents. These ranged from a large increase in federal aid to education by President Johnson to a drastic reduction in federal aid by President Reagan. Finally, the last piece of legislation introduced during the period to further the federal government’s role in education was the No Child Left Behind (NCLB) Act 2001, an act introduced by President George Bush. This was the latest re-

1. Herbert M. Kliebard, *The Struggle for the American Curriculum*, (New York: Routledge 1995), 226.

2. George Bush, *No Child Left Behind*, The White House, 2001.

authorization of the ESEA, but it was somewhat different from the original legislation because it demanded accountability, an issue with which the earlier legislation was not too concerned.

In this chapter I also scrutinize many aspects of the federal role in education. A good example is the fact that, when writing about the federal intervention in education in the period from the National Defense Education Act (NDEA) 1958 to the No Child Left Behind (NCLB) 2001, most historians approach it as a political analysis of the various policy actions. They attempt to understand, for example, why federal intervention in education, which was so strongly opposed up to the 1950s, gradually changed to limited acceptance, and finally became the norm at the turn of the century. Another major concern of historians was the shift of focus from the issue of equity in the ESEA (1965) to the focus on the issues of excellence and accountability in NCLB.³ The distinction is made here because even though some writers believe that excellence implies equity, others think otherwise.

The federal intervention policy has evolved over time, but the evolution has not been smooth.⁴ This is perhaps because of the very strong debates among the various politicians to promote their particular point of view. Debates over the issue have occurred throughout the period and according to Lappan and Wanko the role and priorities of the federal government in

3. Equity is used here in the sense of equal opportunity even though that phrase itself does not have a consensus as to its precise meaning. Throughout this work the word is used to refer specifically to equality of educational opportunity regardless of race, color, ethnicity, gender, or social status.

4. Patrick J. McGuinn, Introduction to *No Child Left Behind and the Transformation of Federal Education Policy, 1965-2005*, (Kansas: University Press of Kansas, 2006).

education will continue to be argued.⁵ In this chapter I make a comparison of the three major pieces of legislation during the period.

The second issue I take up in this chapter is the mathematics curriculum offered to the middle school students during the period. My approach is to look at three distinct curricular movements which occurred during separate but overlapping time frames during the period. The first was the “new math” which made its appearance during what this study calls the reform period, 1958-75. Next was the “back to basics” movement, which appeared during the period, 1972 -88, when many people in the mathematics education community reacted against the “new math.” The third was the period of the standards, 1985-2002. Mathematics curriculum development during this period was led by NCTM which, because of a void in the mathematics education community, automatically assumed the leadership role. As a result this study was divided into those three overlapping time periods. All this is examined in the context of Tyack and Cuban’s idea of the three stages of education policy: *policy talk, policy action, and policy implementation.*

The History of Federal Aid Policy

During the period 1958 to 2002, many pieces of legislation were enacted which furthered federal involvement in education. The culmination of all this federal interest in education was the No Child Left Behind Act (NCLB) 2001. While the NDEA targeted mainly students in higher education, NCLB focused on K-12 students. This act demanded accountability by everyone involved in the education process. NDEA was based on inputs while NCLB was based on

5. Glenda Lappan and Jeffrey J. Wanko, “The Changing Roles and Priorities of the Federal Government in Mathematics Education,” in *A History of School Mathematics*, ed. George M. A. Stanic and Jeremy Kilpatrick, (Reston, V.A: NCTM), 2003.

outputs. NDEA broke new ground by allocating substantial federal funds to education; however it allowed states and local authorities to determine their programs. NCLB on the other hand broke new ground by laying down conditions and policies for states and local authorities to follow.

Subsequent to legislating the NDEA, President Eisenhower tried unsuccessfully throughout his administration to introduce several measures dealing with federal aid to education which were requested by many local education authorities. These local authorities had requested federal aid to assist them with school construction necessary to meet the needs of the new baby boom. President Eisenhower then created a new cabinet-level department, the Department of Health, Education, and Welfare (HEW) to oversee the work of the federal office of education which had been set up in 1867.⁶ Education had become a pressing need as the demand for elementary school places had risen sharply after the war. However President Eisenhower's efforts to alleviate the situation met with some opposition.

Historians largely agree that several factors prevented President Eisenhower from successfully getting his legislation passed. The first was the fear that federal aid might lead to federal control of schools. The second was that federal aid might flow to religious or parochial schools, something that was totally offensive to those who adhered to the principle of the separation of church and state. Along with other historians, Kaestle⁷ believed that the major obstacles to federal aid was what they termed the three "Rs", Race (the threat that federal aid would be coupled with demands for racial desegregation), Religion (aid to parochial schools),

6. The Office of Education was created in 1867 to collect statistics on education.

7 Carl Kaestle, "Federal Aid to Education Since World War II), in *The Future of the Federal Role in Elementary and Secondary Education: A Collection of Papers*, (Washington, D.C.: Center on Education Policy, 2001) 16

and Reds (anti-centralization arguments, including anti-communism). Kaestle further suggested, however, that the work of scholars who have examined the failure of federal aid to education indicate that there were many more obstacles to federal aid. One such obstacle was the Rules Committee of the House of Representatives.

It would seem that all the various reasons given above may be summed up as the three original arguments against the federal role as advanced by Kaestle.⁸ The first was that it was unconstitutional. The reasoning was that according to the constitution all the powers that were not specifically given to the Federal Government resided with the states.⁹ Second, it was felt that local schooling was best left to local decision-makers. Third, it was believed that federal intervention was not necessary because local authorities, with help from their states, could provide proper education for their children.

To further complicate matters for President Eisenhower each of his federal aid to education proposals was amended by Representative Adam Clayton Powell (D-N.Y.). Powell attached a desegregation rider each time, knowing full well that the Southern Democrats, who controlled Congress at that time, were totally opposed to desegregation and would ensure the rejection of any such bill.¹⁰ However, the shock of Sputnik and the subsequent passing of the NDEA caused the controversy over federal aid to segregated schools to subside somewhat. Also

8. Carl Kaestle, "Federal Aid to Education Since World War II), in *The Future of the Federal Role in Elementary and Secondary Education: A Collection of Papers*, (Washington, D.C.: Center on Education Policy, 2001) 16.

9. The Tenth Amendment was being cited here.

10. New York State Education Department, "Federal Education Policy and the States, 1945-2004: A Brief Synopsis," in *States' Impact on Federal Education Policy Project*, (Albany: New York States Archives, 2006), 10.

significant was that with NDEA grants flowed freely to segregated schools. Such was the urgency of the moment that the major issue which had foiled earlier bills was now sidelined.¹¹

In the period immediately after World War II and up to the launch of Sputnik there appears to be a common theme running through the education history of the United States -- that is, the US had gone soft on education and there was a lack of rigor in mathematics education. Hence the country was setting itself up for shortages in areas that were essential to national security.¹² The general consensus of education historians was that the public believed that the Soviet Union had overtaken the United States in the space race and that did not auger well for the future security of this country.

At this time there was much debate as to the extent of federal involvement in education. It was felt by some that state and local authorities were quite competent to develop and provide the training that the students needed. Others believed that the curriculum was too soft and the federal government should intervene to ensure that the nation's youth were educated so that they could help to maintain the nation's military superiority. Kliebard states that people like Arthur Bestor and Admiral Hyman Rickover felt that education fell under the umbrella of national policy especially in time of war, "cold or otherwise," and was therefore open to federal assistance.¹³ In October, 1957, the Russians helped temporarily to settle the debate in their favor.

It would seem from all appearances that NDEA was hastily drawn up and enacted in response to Sputnik, and indeed some historians seem to suggest just that. However, a bill similar

11. New York State Education Department, "Federal Education Policy and the States, 1945-2004: A Brief Synopsis," 12-13.

12. Lappan and Wanko, *The Changing Roles* 903.

13. Kliebard, *The Struggle for the American Curriculum*, 1995; Lappan and Wanko, *The Changing Roles*, 901.

to NDEA had been incubating since the mid-fifties,¹⁴ but there is no doubt that public sentiment over Sputnik tipped the scales in favor of passing such an important bill. NDEA was an important precedent as it opened the door to federal aid for education.¹⁵ It was also important because, according to McGuinn, historically schooling has been a very decentralized and locally run affair; hence it was a political precedent and a “psychological breakthrough for the advocates of federal aid to education.”¹⁶

The major aim of the NDEA was to shore up the nation’s educational and research facilities. Hence it focused on technical development and improvements in students’ academic levels, with particular reference to mathematics, science, and foreign languages. President Eisenhower felt that it was important that America develop its technological might so that it could outdo its Communist foe. As a result an unprecedented amount of federal funds was allocated to support this initiative. Many schools had not sought funding for these areas—they were more concerned with aid for school construction; but they were nevertheless happy to avail themselves of the opportunity to be able to purchase teaching material from federal funds.¹⁷

The Southern Democrats, who were highly instrumental in foiling President Eisenhower’s school construction aid bills, did the same to President John Kennedy, when in 1961, shortly after his inauguration, he proposed a large-scale package of general aid for school construction as well as teacher salaries.¹⁸ This was in keeping with his campaign promises in

14. Kaestle, *Federal Aid to Education Since World War II*, 2001, 22.

15. Lappan and Wanko, *The Changing Roles*, 905.

16. McGuinn, *No Child Left Behind*, 25; McGuinn, *No Child Left Behind*, 28.

17. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 12.

18. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 13.

which he had named six main issues on which he wished to focus. Education was the third of this six. In addition, he raised the issue of education very often during his election campaign, especially with regards to the increase in teacher's salaries. From this it could be concluded that education was high on his agenda.

Although all this would suggest that President Kennedy was very devoted to the cause of education, there has been some debate as to how concerned he really was. Graham observes that while Theodore Sorensen¹⁹ claims that the one domestic subject that mattered most to Kennedy was education, Sorensen's chief lieutenant, Myer Feldman, believed that Kennedy had no deep personal concern for public education. According to Graham, Feldman thought that Kennedy's major concern was in the training of the mentally ill because of tragic personal circumstances. According to Graham, Feldman believed that Kennedy's "accelerating commitment to federal aid as a presidential candidate and as president owed more to practical politics than to the kind of bedrock emotional commitment that drove the former schoolteacher, Lyndon Johnson."²⁰ It appears, though, that this is a very unkind view of Kennedy since, as was mentioned before, as soon as he entered office he proposed a large-scale package of general aid for school construction, and it is well known that he took a particular interest in educational problems associated with urban poverty.²¹

19 Theodore Sorensen was appointed Special Counsel and adviser to President Kennedy in 1960. He wrote extensively on the presidency and foreign affairs until his death in 2010; Hugh Davis Graham, *The Uncertain Triumph: Federal Education Policy in the Kennedy and Johnson Years*, (Kansas: University Press of Kansas 1984), 3

20. Graham, *The Uncertain Triumph*, 3.

21. Graham, *The Uncertain Triumph*, 3.

Kaestle seems to agree with Sorensen when he says that “Kennedy had long supported the growth of federal aid to schools.”²² He further claims that President Kennedy had supported federally subsidized school lunch programs since 1946 when he first ran for Congress. In addition to all this, during his fourteen years in Congress, he had proposed several bills to provide for school construction, instructional materials, and many other bills that provided service to schools. Feldman’s view of Kennedy appears therefore to be somewhat warped and very unkind to someone, who, although he was unable to secure any major legislation on education, was one of its staunchest supporters.

As soon as he was elected to office President Kennedy immediately set about fulfilling his campaign promises with regard to education. He set up an education task force headed by Frederick L. Hovde, who was at that time the president of Purdue University. This high-powered committee also contained such prominent names as Francis Keppel, Dean of the Harvard School of Education; Alvin Eurich, a vice-president of the Ford Foundation; Russell Thackery, executive secretary of the American Land-Grant Colleges Association; John Gardner, president of the Carnegie Corporation; and Benjamin Willis, superintendent of public schools in Chicago.²³ This was a body with authority to speak knowledgeably on matters of higher education. Graham suggests that It was unfortunate that President Kennedy did not see it fit to have representatives of the conservative, southern Democratic, Catholic Church, or NAACP positions on the committee. This appears to have been a serious oversight on his part.²⁴

22 New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 13.

23. Francis Keppel later served as US Commissioner of Education (1962-65) and was instrumental in developing the Elementary and Secondary Education Act (ESEA) 1965.

24. Graham, *The Uncertain Triumph*, 11.

The Commission recommended over \$9 billion in grants and loans over the next five and a half years. Of this amount \$5.84 billion was to go to public schools only in the form of grants to the states.²⁵ Graham believes that the report envisaged a massive and permanent role in education, with some aid to private and parochial schools in higher education, but no aid for them in elementary and secondary education. The President was not too pleased with the extremely high cost envisaged in the report, and felt that he would be attacked by the press. His worst fears were confirmed when on February 7, 1961, just three days before his inauguration, the report was released to the press. As was expected the conservative press was highly critical of the proposal. But the most serious criticism came from the Catholics. Graham quotes the *New York Times*, 18 January 1961, which reported that Cardinal Spellman severely criticized the report, complaining that no American child should be denied the federal funds “which are allotted to other children which are necessary for his mental development because his parents chose for him a God-centered education.”²⁶

President Kennedy made valiant efforts to have his election promises fulfilled, but he was confronted by obstacles at every turn. A month after his inauguration he recommended a three-year program of general federal assistance for public elementary and secondary classroom construction and teachers’ salaries. He emphasized, however, that no funding would be allocated for the construction of church schools nor for church school teachers’ salaries. This recommendation met with a combined opposition from the National Catholic Welfare Conference (NCWC), Southern Democrats, and a majority of the Republicans in the House.

25. The grants to the states were specifically for school construction, teachers’ salaries, and any other appropriate educational purposes.

26. Graham, *The Uncertain Triumph*, 13.

After a great deal of negotiation and compromises, a much watered-down version was introduced later in the year. That too was defeated by the combined opposition. It was “denounced by Catholics as discriminatory, by the National Education Association (NEA) as woefully inadequate, and by the House Republicans as a railroad job.”²⁷

Graham, lamented the lack of success on the part of the Kennedy administration with regard to federal general aid for education. He says that “the Kennedy administration pressed vigorously for federal aid during 1961-63, but the political sources of objection to the various forms such aid might take became so locked into intransigent patterns of resistance and mutual veto that the Kennedy program was widely branded by contemporaries as a ‘fiasco.’”²⁸ Thus, many historians recognize the difficulty that President Kennedy faced in attempting to fulfill his election pledges.

Kennedy’s failure was Johnson’s success. President Kennedy was unable to get his general aid package passed because of the several previously discussed reasons. It was therefore left to President Johnson, who, continuing the legacy of President Kennedy, found a way to have such a measure passed. The groundwork for President Johnson’s War on Poverty was laid very early in his administration. By the end of 1964 he had already obtained passage of several of his education initiatives, including the Vocational Education Act and the Higher Education Act of 1963. He was now prepared to introduce his major piece of legislation on education. He had witnessed first-hand Kennedy’s struggle to get a comprehensive bill on education through Congress. He treaded warily with his legislation, carefully avoiding the Kennedy pitfalls.

27. Graham, *The Uncertain Triumph*, 24.

28. Graham, *The Uncertain Triumph*, xviii.

President Johnson believed that the aid to education offered by the NDEA and the various impact-aid programs were insufficient to meet the needs of the growing number of underprivileged students. His response to this was the Elementary and Secondary Education Act (ESEA) 1965.

Kaestle claims that the Johnson administration presented the ESEA as a “response to a crisis of poverty and racial disharmony that could be alleviated by educational opportunity,” and it appears that in this way he was able to capitalize on the mood of the country at that time.²⁹ While the NDEA found immediate passage because of its defense title and its apparent commitment to education funding for national security, ESEA had to be cleverly crafted and an ingenuous compromise had to be devised so that the bill could be made more appealing to the various factions who previously opposed federal aid to education. The dilemma of federal aid to parochial schools was circumvented by attaching the school-aid bill to impact aid bills and thus granting funds to schools on the basis of total student enrollments rather than just public school enrollments.³⁰

The ESEA was the centerpiece of President Johnson’s plan for the Great Society. It was a new commitment to “educational equity” as it greatly increased the federal financial involvement in elementary and secondary school education.³¹ Most historians believe that ESEA was in fact an attempt to come to terms with the civil rights movement and as a result focused on the less fortunate in society. Lappan and Wanko say that the issue of educating children who had been

29. Kaestle, *Federal Aid to Education Since World War II*, 2001, 20.

30. McGuinn, *No Child Left Behind and the Transformation of Federal Education Policy*, 30; New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 17.

31. Goertz, “The Federal Role in an Era of Standards-Based Reform,” in *The Future of the Federal Role in Elementary and Secondary Education: A Collection of Papers*, (Washington, D.C.: Center on Education Policy, 2001), 51.

underserved became a lever for the creation and passage of the ESEA.³² Whereas the NDEA emphasized science and mathematics, the ESEA was a federal response to the significant social change taking place in American society.

Even though there was still much opposition to federal aid, the bold step taken in that direction by NDEA greatly facilitated the passing of the Elementary and Secondary Education Act (ESEA). This Act, also called Public Law 89-10, was signed seven years after the NDEA by President L.B. Johnson in 1965.

From the beginning of the Kennedy era to the end of the Carter era, much effort was made to improve the lot of those students who were underprivileged. The focus of the period 1961 to 1981 was to assist the underserved in society. This is nicely captured by Graham when he says that since the Republican administrations of Presidents Nixon and Ford were never able to effectively master their Democratic Congresses, “there is a strong line of domestic program continuity between the Kennedy victory of 1960 and the culminating administration of President Carter through 1980.”³³ He believes that during these two decades of “dramatically expanding” federal involvement in education, which included the major Nixon expansion in 1972 of aid to college students rather than institutions, “the access of the disadvantaged to the fruits of education at all levels was greatly expanded.”³⁴

This focus on the disadvantaged started with the failed attempts by President Kennedy and materialized with the ESEA in President Johnson’s first term. Many African-American and Hispanic students, as well as members of other minority groups, especially in inner-city areas,

32. Lappan and Wanko, *The Changing Roles*, 911.

33. Graham, *The Uncertain Triumph*, 216.

34. Graham, *The Uncertain Triumph*, 216.

were educationally disadvantaged because of social and economic conditions. McGuinn suggests that the ESEA was meant primarily to be a redistributive bill, intended “to put a floor under the nation’s poorest communities.”³⁵ It could be said, therefore, that ESEA was critically important for two reasons:

- a) it created a number of educational opportunities in schools that serve children in lower socio-economic settings;
- b) it represented a departure from the stance the United States had taken throughout its history against any intrusion of the federal government into the educational affairs of states and local communities.³⁶

Many critics of ESEA believe that the easy availability of funds was taken advantage of by some unscrupulous school districts. The document *Federal Education Policy and the States* supports this; it claims that many relatively wealthy school districts took advantage of ESEA grants.³⁷ Although the ESEA required states to evaluate their programs periodically and to report the results to the federal commissioner of education, no one seemed to enforce this requirement. While the program was intended for the neediest in society, wealthy districts were able to manipulate the system to obtain funds. This however “led to worries that the ESEA might become a financial delivery system with no real effect on school programs or student achievement in low-income areas.”³⁸

35. McGuinn, *No Child Left Behind*, 31.

36. Lappan and Wanko, *The Changing Roles*, 911-912.

37. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 18.

38. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 18.

The ESEA was extremely attractive to states and school districts because its five programs provided “previously unimaginable sums of aid for schools.”³⁹ According to McGuinn Title I was the centerpiece of the ESEA.⁴⁰ It aimed to improve not only educational opportunities, but educational outcomes, for disadvantaged children. This program received \$1.06 billion of the initial \$1.3 billion appropriated for ESEA. The money was to be used for such things as equipment, constructing classrooms, and hiring additional staff. Title II provided federal grants to improve library services and to purchase multi-media equipment, instructional materials, and textbooks to be loaned to public and nonpublic schools. Title III provided federal grants to improve language acquisition. Title IV provided federal grants to improve research in effective teaching strategies. Title V funded the expansion of state departments of education.

A 1966 amendment to the Elementary and Secondary Education Act (1965) created a new program, Title VI to provide grants for handicapped children. In 1970 Title VI was broken from ESEA and expanded to form a separate Education of the Handicapped Act. This later became the Education for All Handicapped Children Act (1975), which later became the Individuals with Disabilities Education Act (IDEA) 1997. Although the total public education population declined between 1968 and 1986, the number of children in special education programs in the United States increased over the period from 2.3 million to 4.3 million. Hence the growth of the separate program to assist them was necessary.⁴¹

39. McGuinn, *No Child Left Behind*, 31.

40. McGuinn, *No Child Left Behind*, 31.

41. McGuinn, *No Child Left Behind*, 38.

McBeath, Reyes, and Ehrlander claim that in the judgment of many scholars ESEA has undergone three distinct phases.⁴² The first was during the initial period of operation, “it projected bold expectations, but was unclear with respect to its objectives, imprecise in its expectations, and inept in its administrative actions.” The second phase saw policymakers attempting to fix the problems revealed in its implementation. In the third phase there was recognition of the need for local diversity in approach and implementation style. The major criticism of ESEA however, is the fact that it has been consistently unable to close the achievement gap between poor and affluent students. although its original intention was to provide support for the education of socioeconomically disadvantaged students.

The presidential administration of Richard Nixon could be considered the most active since World War II in terms of a steadily expanding role in public education.⁴³ President Nixon appointed former New York State Commissioner of Education James Allen to serve both as federal commissioner of education and as assistant secretary of education in the Department of Health, Education, and Welfare (HEW). Commissioner Allen was very experienced in this area, having served in New York State when New York City was experiencing a great deal of difficulty with its education system in the 1960’s. Since one of President Nixon’s greatest challenges was the continuing desegregation problem he was well served by recruiting the services of Commissioner Allen whose experiences with New York City included the desegregation conflict that occurred there.

42. Jerry McBeath, Maria Elena Reyes, and Mary Ehrlander, *Education Reform in the American States*, (Charlotte: Information Age Publishing, Inc., 2008), 14.

43 New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 23.

Allen immediately became concerned with the effectiveness of the federally funded programs, due in part to a series of criticisms leveled against the federal office of education. For example, two policy analysts released a scathing critique of Title I. Their study, *Title I of ESEA: Is It Helping Poor Children?*,⁴⁴ claimed that many states had misused Title I funds and, because of this, the study found that the goals of the program were being undermined. So concerned was Commissioner Allen that he proposed a new National Institute of Education (N.I.E.)⁴⁵ to study education programs and to study the link between federal aid and student performance in inner-city schools.⁴⁶ This was the beginning of the use of student achievement to measure the effectiveness of federal funds.

President Nixon, throughout his administration, had a great interest in implementing welfare reform programs. A major part of this welfare reform concern was in developing child care programs. In this he was well supported by legislators who were quite partial to the idea of assisting poor children. Further, the program intended to expand Head Start, a program begun under President Johnson in 1965.⁴⁷ Elizabeth Rose says that many legislators saw child care as a natural component of education policy, and after enacting various bills in the 1960's in support of elementary and secondary schools, as well as for higher education, "child care seemed the

44. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 24.

45. NIE was established in June, 1972, and was located in the Education Division in the Department of Health, Education, and Welfare (HEW). It was transferred to the Office of Educational Research and Improvement (OERI) in 1978. NIE was abolished in 1985 as a result of the reorganization of OERI.

46. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 24.

47. Head Start was started as part of President Lyndon Johnson's War on Poverty in 1965. It was designed to help end poverty by providing help to children of low income families.

next logical step.”⁴⁸ However, it was unfortunate that when Congress eventually passed a bill, the Comprehensive Child Development Act in 1971, to assist President Nixon, under pressure from the right wing of his party he was forced to veto it. According to Rose, “the bill offered substantial funding (\$2.5 billion for fiscal year 1973) for child care centers,” but these “right-wingers” were afraid that the legislation would undermine the family, Sovietize U.S. children, and worst of all, promote racial integration.⁴⁹

While President Nixon focused on child care, the Ford assistance to education was concerned with the disabled. In particular, the largest federal program for the education of the handicapped came in 1975 with the passage of the already mentioned landmark Education for All Handicapped Children Act. This measure got easy passage because it was well supported by a host of interest groups such as the Council for Exceptional Children (CEC), the National Education Association (NEA), the Council of Great City Schools (CGCS), the Council of Chief State School Officers (CCSSO), the National Association of School Boards (NASB), the National Association for Retarded Children (NARC), and many others.⁵⁰

It cannot be denied that the issue of special education for the disabled had received “steadily increasing attention” in Congress since the Kennedy administration. Both Presidents Johnson and Nixon contributed to the number of programs designed to help the handicapped. However, a major push was made with the reauthorization of the Elementary and Secondary Education Act in 1974 when the federal aid to special education was boosted from \$100 million

48. Rose, “Where Does Preschool Belong? Preschool Policy and Public Education, 1965-Present,” in *To Educate a Nation: Federal and National Strategies of School Reform*, ed. Carl Kaestle and Alyssa Lodewick, (Kansas: University Press of Kansas, 2007), 285.

49. Rose, “Where Does Preschool Belong?” 284; Rose, “Where Does Preschool Belong?” 285

50. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 36.

(in 1974) to \$660 million (in 1975). These grants did not have a poverty criterion and as such flowed to school districts regardless of their wealth.⁵¹

During his election campaign President Carter pledged to create a new cabinet level department to oversee “the rapidly growing panoply of federal aid programs.”⁵² He kept his promise, and in 1979 Congress passed the Department of Education Organization Act by a narrow margin in both houses. No one was sure how a new department of education would affect the federal role in education, but what was certain is that there were many complex administrative issues that needed immediate attention. The challenge in the Carter years was not only to decide how to provide equal opportunities for diverse groups of students but also how to pay for all the new programs that the federal courts demanded.⁵³

Not only did the federal government outdo itself with the ESEA in 1965, but Kaestle claims that between 1957 and 1978 the trajectory of federal intervention was generally upward in terms of funding, even though the road was bumpy.⁵⁴ However, all that changed when President Reagan took office. As soon as he took office there was a distinct shift in the federal policy on education. Ravitch presents a conventional but still persuasive portrait of President Reagan as a man filled with disdain for a federal role in education.⁵⁵ He did not believe in “big government” and firmly decided to bury what he considered to be the myth that “big government” brought

51. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 36.

52. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 40.

53. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 40.

54. Carl Kaestle, “Federal Education Policy and the Changing National Polity for Education, 1957-2007,” in *To Educate a Nation: Federal and National Strategies of School Reform*, ed. Carl Kaestle and Alyssa Lodewick (Kansas: University Press of Kansas, 2007), 29.

55. Diane Ravitch, *Left Back: A Century of Failed School Reforms*, (New York: Simon & Shuster 2000), 411.

more opportunity and compassion. As a result, in 1981, he gained passage of a bill, the Education Consolidation and Improvement Act (ECIA), to drastically reduce the provisions of ESEA.⁵⁶ Ably supported by a strong Republican presence in Congress, he was able to set about reducing and redefining the federal role in education. To him, the guiding principles of the federal role should be privatization, choice, and competition, rather than equity. However his eagerness to reduce the federal role in education was soon tempered by the publication of the report, *A Nation at Risk*.

The publication of *A Nation at Risk* in 1983 by the National Commission on Excellence in Education (NCEE) forced the nation to take a serious look at the situation in education. This report claimed that American “students were not studying the right subjects, were not working hard enough, and were not learning enough. Their schools suffered from slack and uneven standards.” *A Nation at Risk* suggested that public schools needed to be reformed drastically so that they could give priority to the sciences and mathematics. In emotive language that has become familiar to many in the field of education, the report observed that “If an unfriendly power had attempted to impose on America the mediocre education that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves.”⁵⁷ These comments are very similar to those expressed by Admiral Rickover 24 years earlier.

Both President Reagan and Secretary of Education Terrence Bell had hoped that the report would support their views. McGuinn suggests that Bell believed that the report of the commission would show that the public schools were doing a satisfactory job. While the report

56. McGuinn, *No Child Left Behind*, 42.

57. National Commission on Excellence in Education, *A Nation at Risk*, <http://www.ed.gov/pubs/NatAtRisk/risk.html> (assessed May 15, 2008).

did not endorse the Reagan plan to eliminate the Department of Education, or call for the creation of vouchers to support private schools, it also did not deliver the positive endorsement of public schools for which Bell had hoped.⁵⁸ The Report did not alter the position of the Reagan administration, but it did, however, help to create public awareness and therefore restricted the all-out assault by the administration on the federal involvement in education. As a result the trend toward greater federal control in education continued in the 1980s “despite the concerted efforts of President Reagan and his conservative administration.”⁵⁹

The block grant was a long-standing method of federal aid disbursement favored by the Republicans.⁶⁰ In 1967, Representative A. Quie (R-Minn) proposed an amendment to replace “categorical” grants with “block grants” to the states. He was at that time a member of the House Education and Labor Committee and felt that state education agencies were better able than the federal Office of Education to distribute the ESEA funds. The block grant proposal did not find favor with large urban city school superintendants and civil rights groups. They believed that the best way to ensure that federal aid went to the most disadvantaged students was to allow the federal administration of the program. In particular, the NAACP felt that the block grant could become a vehicle for getting around racial guidelines if states were not willing to enforce them.⁶¹

The federal emphasis on equity shifted after the end of the Reagan administration, and when President George H.W. Bush took office the federal emphasis gradually moved towards a

58. McGuinn, *No Child Left Behind*, 43.

59. McGuinn, *No Child Left Behind*, 45.

60. A block grant is a sum of money given to an education authority with no specific conditions as to how that money is to be spent. On the other hand a categorical grant is one with specific direction as to how the money should be spent.

61. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 19.

greater focus on excellence and less on equity. The Bush policy on education appears to have been based on the Standards movement. This move followed from his meeting with the fifty governors in Charlottesville, Virginia, in 1989. At this meeting there was a basic agreement that there should be national education goals.⁶² Tyack and Cuban point out that such an agreement would have been an anathema not so long ago.⁶³ The Clinton (Gov. Clinton was a major player in the Charlottesville meeting) administration continued along this path and tried to tie in some equity policies with its focus on standards reform. Since then there has been an attempt to do a balancing act. This has prompted Kaestle to ask, “What balance shall we strike between an emphasis on equity and an emphasis on excellence?”⁶⁴ In enacting the Improving America’s Schools Act (IASA) 1994, the Clinton administration adopted the push for standards and sought to obtain excellence for all students.

In 2001, a new Republican President introduced a piece of legislation which “surprised many of his conservative supporters.”⁶⁵ While many conservatives were still opposed to any form of federal intervention in public education, President George Bush introduced the No Child Left Behind (NCLB) Act, one which had very strong oversight of the standards movement. In the mid-twentieth century the federal emphasis had been on a concern for underprivileged children; at the end of the century the emphasis shifted toward a concern for all students. McGuinn argues that the passage of NCLB has changed federal education policy and in so doing created a new policy regime. “The old federal education policy regime, created in 1965, was

62. McGuinn, *No Child Left Behind*, 61.

63. D. Tyack and Larry Cuban, *Tinkering toward Utopia A Century of Public School Reform*, (Cambridge: Harvard University Press, 1995), 81.

64. Kaestle, *Federal Aid to Education*, 32.

65. Kaestle, “Federal Education Policy, 1957-2007,” 29.

based on a policy paradigm that saw the central purpose of school reform as promoting equity and access for disadvantaged students.⁶⁶ He suggests that the policy regime of NCLB is centered on the much broader goal of improving education for all children.⁶⁷

David Karen claims that from the perspective of goals, degree of financial involvement, and even strategies, the country has not come far in the decades since the enactment of ESEA.⁶⁸ He says, “Despite the changes, the goals of our new ESEA are similar to those mentioned by LBJ;” but it appears that the goals of NCLB were far broader than those of ESEA. As was indicated earlier, ESEA’s main goal was catering to the underprivileged children, while NCLB focused on all children. Therefore, one could conclude that federal involvement has shifted over the last fifty years from a policy that focuses only on the underprivileged children in the society to one that focuses on all children.

The major question, then, is how the various federal intervention policies affected mathematics education in New York City during the period. Since New York City is one of the most diverse cities in the United States, it is necessary to examine what effects the two important pieces of federal legislation, NDEA and ESEA, had on its students. All this must be examined in the context of the political and social upheavals in New York City in the late 1950s to 2002: the struggle for integration, the fight for community control of schools, the teachers’ strike of 1968, and the financial crisis of the mid-1970s.

66. McGuinn, *No Child Left Behind*, 93.

67. McGuinn, *No Child Left Behind*, 194.

68. David Karen, “Changes in Access to higher Education in the United States,” in *A Sociology of Education: A Critical Reader*, ed. Alan Sadovnik, (New York: Routledge 2007).

History of Mathematics Curriculum

Historians of mathematics education who study the period from 1958 to 2002 seem to agree that discussions about the much maligned “new math” dominated the early part of the period while the standards movement dominated the latter part, with the back to basics movement separating the two.⁶⁹ First, the period 1958 to 1975, also known as the “new math” period, was considered to be the reform period because of the number of curriculum groups engaged in developing mathematics curricula at the time. Second, the period 1972 to 1988, called the “back to basics” period because of the backlash against the “new math” and a call by the public to return to the traditional mathematics curriculum. Third, the period 1985 to 2002, considered to be the period of the standards movement. This movement came about as a result of a few reports, chief among which were two produced by the National Council of Teachers of Mathematics (NCTM), *An Agenda for Action, 1983*, and *Curriculum and Evaluation Standards for School Mathematics, 1989*.

These three periods, or phases of reform, could be said to define what took place in American mathematics education during the second half of the twentieth century. Tyack and Cuban’s⁷⁰ idea of the three stages of policymaking is useful in examining these periods because it describes the cycle that occurs leading up to the adoption of the various mathematics curricula. They suggest that at first there is *policy talk*. This is where problems are diagnosed and solutions are advanced. Second, there is *policy action*. In this instance the recommended reforms are adopted through state legislation, local district, or some other relevant authority. Third, there is

69. Angela Lynn Evans Walmsley, *A History of the “New Mathematics” Movement, and its Relationship with Current Mathematical Reform*, (Lanham: University Press of America, INC. 2003); Fey and Graeber, “From the New Math to the Agenda for Action”, 2003.

70. Tyack and Cuban, “Tinkering toward Utopia A Century of Public School Reform,” 40.

policy implementation. Tyack and Cuban claim that this stage is much slower and more complex than the other two. The implementation of any reform is always very difficult and in the case of mathematics education, teachers have to be retrained both in content and pedagogy. Some historians suggest that the perceived failure of the “new math” in the 1960s was partly due to the fact that many teachers did not fully understand the “new math” and therefore were unwilling to implement it.⁷¹

Many writers seem to think that mathematics education was greatly affected by the Soviet’s launch of Sputnik.⁷² Walmsley claims that the launching of Sputnik became the “most influential promoter of mathematics education in the United States.”⁷³ Payne suggests that it is true to say that the launch of Sputnik startled Americans and forced them to examine the state of mathematics education in the country.⁷⁴ The fact is, though, that mathematics education reform was a concern before this, and a new secondary school mathematics curriculum project, University of Illinois Committee on School Mathematics (UICSM), had begun much earlier than 1958. The general view of most historians, however, is that Sputnik brought national attention to mathematics education with a resulting resurgence in the United States.

71. Angela Lynn Evans Walmsley, *A History of the “New Mathematics” Movement, and its Relationship with Current Mathematical Reform*, (Lanham: University Press of America, INC. 2003) 81; Fey and Graeber, “From the New Math to the Agenda for Action”, 2003, 536.

72. Alan W. Garrett and O. L. Davis, “A Time of Uncertainty and Change: School Mathematics from World War II until the New Math,” in *A History of School Mathematics*, ed. George M. Stanic and Jeremy Kilpatrick, (Reston VA: NCTM, 2003) 513; Fey and Graeber, “From the New Math to the Agenda for Action,” in *A History of School Mathematics*, ed. George M. Stanic and Jeremy Kilpatrick, (Reston VA: NCTM, 2003), 3; Ravitch, *Left Back: A Century of Failed School Reforms*, 327; Walmsley, *History of the “New Mathematics” Movement*, 12.

73. Walmsley, *A History of the “New Mathematics” Movement*, 12.

74. Joseph Payne, “The New Math and its Aftermath, Grades K-8,” in *A History of School Mathematics*, ed. George M. Stanic and Jeremy Kilpatrick, (Reston VA: NCTM, 2003), 562.

Historians see the renewed concern with mathematics education in the period from the mid-1950s to the late 1960s as a reaction against the postwar mathematics curriculum which was based on life adjustment.⁷⁵ Some historians seem to disfavor life adjustment education. Kliebard for one is very critical of it.⁷⁶ He refers to it as “that dismal chapter in the history of educational reform.” He believes that life adjustment education was mainly a “slogan system rather than a concrete agenda for reform.” Life adjustment education depended on the basic tenet of social efficiency, which was that the principal function of schooling should be the adjustment of students to the social world in which they live.⁷⁷ He claims that the scheme’s roots in the basic trivialities of daily living proved to be uninspiring. Mathematics education policy in the immediate post-war period, therefore, while strongly favored by those who supported life adjustment education, seemed to find great disfavor with many later historians.

To Ravitch the postwar curriculum was “unabashedly anti-intellectual.” It was a form of life adjustment prescribed by the bureaucrats.⁷⁸ She says that life adjustment was an amalgam of all the Pre-War factions of Progressive Education. This curriculum was intended to meet the needs of the nation’s youth, and as such the experts advised that the mathematics curriculum should concentrate on practical problems “such as consumer buying, installment buying, insurance, taxation, and home budgeting” for the students in the life adjustment program. Courses in algebra, geometry, and trigonometry should be reserved for the college-bound.⁷⁹ Ravitch complains that life adjustment pointedly neglected any concern for students’ intellectual

75. Garrett and Davis, *A Time of Uncertainty*, 513.

76. Herbert M. Kliebard, *Changing Course American Reform in the 20th Century*, (New York: Teachers College Press) 133.

77. Garrett and Davis, *A Time of Uncertainty*, 511.

78. Ravitch, *Left Back: A Century of Failed School Reforms*, 327.

79. Ravitch, *Left Back: A Century of Failed School Reforms*, 329.

growth.⁸⁰ She was severely critical of the life adjustment experts. She felt that they envisaged a static society in which the occupations of the present would remain unchanged. They were adjusting young people to a world that was already passing instead of equipping them with the knowledge and skills “to deal with an unpredictable future.”⁸¹ She considered this to be regressive and undemocratic.

The move away from life adjustment and the adoption of the “new math” curriculum by states and local authorities was, of course, purely voluntary; and while some districts bought in to the new program, quite a few chose to remain with the traditional curriculum. It is not clear, based on the conflicting views of various historians, how well the “new math” was received. According to Payne, “Almost every school and school system clamored to find out about the “new math” because they could not be viewed as being behind the times.”⁸² On the other hand Davis says that there was little justification for the claim that the “new math” was tried out in schools all over the United States, as most schools seem to have been hardly affected at all.⁸³ He further stated that one description likened the “new math” to a storm on the surface of the ocean, having no effect on those who dwell on the ocean floor. Walmsley’s view is that those schools most affected by the “new math” were small cities and suburban areas.⁸⁴ Many small town schools and rural areas never adopted the “new math.” It may be fair to say, then, that the “new math” was adopted by some school districts, but many of them continued with the traditional curriculum.

80. Ravitch, *Left Back: A Century of Failed School Reforms*, 327.

81. Ravitch, *Left Back: A Century of Failed School Reforms*, 331.

82. Payne, “The New Math and its Aftermath,” 575

83. Davis, “Changing School Mathematics,” 625.

84. Walmsley, *A History of the “New Mathematics” Movement*, 88.

To determine how widespread was the use of the “new math” materials developed by the various curriculum development groups one has to examine what took place in classrooms all across the country. However, there is not much information on this aspect of the “new math.” The adoption for use by various school systems is one thing, but the implementation by teachers is quite another. Davis believes that there was very little implementation of the “new math” in schools because he claims that it was possible to walk into almost any school in the United States and see “mathematics teaching that was little different from typical teaching before World War II.”⁸⁵ In some instances, even with excellent instructional materials, implementation was a major task.⁸⁶ Some teachers still taught the material with great reluctance even after substantial training.

Many school mathematics projects were started in the late 1950s and early 1960s due to pressure to improve the mathematical ability of college-bound students. The release of significant amounts of funds by the federal government, mainly through the National Science Foundation (NSF), facilitated many of these new reform projects. For instance, the University of Illinois Committee on School Mathematics (UICSM) which started work in 1951 received part of its funding from the NSF, while the School Mathematics Study Group (SMSG), founded in 1958, received the major part of its funding from the NSF.

Notwithstanding the concern of some writers, the new mathematics appears to have been well accepted by some people in the mathematics community. The “new math” programs were, according to Walmsley, “for the most part, positively presented and received.”⁸⁷ However critics

85. Davis, “Changing School Mathematics,” 625.

86. Payne, *The New Math and its Aftermath*, 596.

87. Walmsley, *A History of the “New Mathematics” Movement*, 29.

of the various new programs still felt that the new mathematics was failing students. Walmsley says that so strong were the feelings in some quarters that an article appeared in the *Mathematics Teacher* in 1962 with a letter signed by 65 mathematicians who criticized the “new math.”⁸⁸ A major criticism of the “new math” era was that many project writers focused mainly on students with high abilities in mathematics, and the reform needed to analyze methodologies and content for all academic levels students.⁸⁹

The strong disenchantment with the new math by quite a few members of the mathematics community fueled the drive to go “back to basics.” Walmsley says that as the mathematics curriculum focused on “back to basics,” the National Council of Teachers of Mathematics (NCTM) “saw the direction for mathematics curriculum across the nation disintegrate during the 1970s.”⁹⁰ To some writers, mathematics education appeared to have been in a state of limbo during the “back to basics” period as the mathematics education community seemed to be groping for a clearer focus and sense of direction.⁹¹

Therefore, even though the traditional curriculum was being used in quite a few schools, many leading mathematics educators were unhappy with it and started planning for reforms in different directions.⁹² This led to standards reform which was the prevailing mathematics education movement during the mid to late 1980s. The standards movement certainly had an impact on mathematics education, and Walmsley claims that many authors of textbooks and

88. Walmsley, *A History of the “New Mathematics” Movement*, 83.

89. Walmsley, *A History of the “New Mathematics” Movement*, 85.

90. Walmsley, *A History of the “New Mathematics” Movement*, 90.

91. Fey and Graeber, “From the New Math,” 549

92. Fey and Graeber, “From the New Math,” 550

journals have indicated that there has been a large effect.⁹³ The question is, will that effect continue to be positive or will there be another return to basics?

When the new math faded in the mid-1970s, there were calls for a return to the basics. As Fey and Graeber suggest, the major reason for the “back to basic” movement was an emerging public opinion that the new math reforms were a failure.⁹⁴ This could have been caused by the fact that the new math programs that reached the schools “lacked the pedagogical ideas expressed by the pioneers of new math.”⁹⁵ Payne, who was closely associated with some members of the School Mathematics Study Group (MSG) writing team, writes enthusiastically about the new math materials developed by MSG.⁹⁶ So thrilled was he about the new programs and what was happening during the period that he proclaimed the 1960s to be the golden decade of mathematics, and he further stated, “If the 1960s were the zenith decade, then the 1970s were the nadir.”⁹⁷ While the return to the traditional curriculum was a cause of joy to some it was certainly a cause of disappointment to those who supported the “new math” movement.

Since the vast majority of school districts were likely unaffected by the “new math” movement it could be said that in most cases there was no change in the curriculum with the advent of the “back to basics” movement, but a continuation of business as usual. Fey and Graeber wonder whether “back to basics” might not have more aptly been called “on with basics.”⁹⁸ Hence there was no need for these school districts to engage in policy action. Further,

93. Walmsley, *A History of the “New Mathematics” Movement*, 122.

94. Fey and Graeber, “From the New Math,” 539

95. Walmsley, *A History of the “New Mathematics” Movement*, 82.

96. Payne, “The New Math,” 590.

97. Payne, “The New Math and its Aftermath,” 590.

98. Fey and Graeber, “From the New Math,” 538

since the teachers were happy using the traditional material it is safe to say that there was no problem with its implementation in the classroom.

The National Council of Teachers of Mathematics laid the groundwork for policy change in the 1980s. The professional body initiated policy talk with its two publications, *An Agenda for Action* and *Curriculum and Evaluation Standards for School Mathematics*. According to Ravitch these standards were intended to regain lost ground after the new math and the “back to basics” movement and she claims that they were an immediate success.⁹⁹ The federal government and many states found these standards useful as models for their own standards. Thus, the standards dominated mathematics education after its publication in 1989.¹⁰⁰ Since the enactment of the NCLB, implementation of the standards is mandatory and it is monitored by the states through the accountability provision in the Act.

Mathematics curriculum efforts in the period 1958 to 2002 have experienced many changes in direction. Each period was marked by a particular movement. The fact is that no movement is ever completely dead and there is always some part of the old movement retained in the new. As Walmsley suggests many of the topics introduced in the “new math” era are present in the curriculum at the end of the period although they seemed to have been discarded during the “back to basics” movement.¹⁰¹ Hence what appears to be the best topics, methods and practices are kept and amalgamated in the new program. The ultimate aim of all the mathematics curriculum efforts is to be able to teach children mathematics better. There is, therefore, a

99. Ravitch, *Left Back: A Century of Failed School Reforms*, 439.

100. Walmsley, *A History of the “New Mathematics” Movement*, 93.

101. Walmsley, *A History of the “New Mathematics” Movement*, 120.

continuous effort to improve both the curriculum and the pedagogy. It is a work in progress, evolving over time, and as with evolution the end is not clearly in sight.¹⁰²

Summary

This chapter examined the various twists and turns of the federal intervention in education during the period starting with the National Defense Education Act (NDEA) 1958 and ending with the No Child Left Behind Act (NCLB) 2001. It examined the opposition to any form of federal role in education and the effect that the launching of Sputnik by the Russians in late 1957 had on the debate. While a Bill similar to NDEA was incubating well before 1958 it appears that the fear aroused by Sputnik assisted the passing of this important piece of legislation. The opposition to the NDEA was stymied by President Eisenhower tying the Bill to national defense.

Perhaps emboldened by the passage of the NDEA the federal government developed the courage seven years later to attempt a more far reaching piece of legislation, the Elementary and Secondary Education Act (ESEA) 1965. President Kennedy was unfortunate as he was completely obstructed from passing any legislation that increased the federal role in education. At every turn he was opposed by any one of, or all of the three groups: the National Catholic Welfare Conference (NCWC), the Southern Democrats, and a majority of the Republicans in the House. But Kennedy's failure was Johnson's success. As was indicated earlier President Johnson treaded warily with his legislation, carefully avoiding the Kennedy pitfalls. He was therefore successful in negotiating the ESEA through Congress.

102. Walmsley, *A History of the "New Mathematics" Movement*, 124.

Not all the federal administrations were favorable to a role in education, some administrations felt that this created a bigger government, and this was to be avoided at all costs. Hence the federal role increased uninterrupted from the Eisenhower era up to the Carter era but there was a reversal as soon as President Reagan took office. He was totally opposed to the idea of federal intervention in education and felt that education should be left to the states and the local education authorities. Further, he was an ardent supporter of smaller government and introduced legislation, the Education Consolidation and Improvement Act (ECIA) 1981, in an attempt to reduce the federal role in education.

While the ESEA focused on equity and, as suggested by McGuinn, it was meant primarily to be a redistributive bill intended to put a floor under the nation's poorest communities, the NCLB focused on excellence.¹⁰³ As a result NCLB claimed to focus on all children. The question then is whether excellence implies equity. Some scholars disagree that it does, for example Kaestle was prompted to ask, "What balance shall we strike between an emphasis on equity and an emphasis on excellence?"¹⁰⁴ However, NCLB's most distinctive feature was its emphasis on accountability; as such it focused on outputs while the ESEA focused on inputs.

The federal role in education manifested itself in mathematics education through curriculum development in the 1950s and early 1960s. The National Science Foundation which was supported by the federal government funded several of the curriculum development groups who were involved in preparing the "new math" curriculum. Two of these were the School

103. McGuinn, *No Child Left Behind*, 31.

104. Kaestle, *Federal Aid to Education*, 32.

Mathematics Study Group (SMSG) who received most of its funding from the NSF, and the University of Illinois Committee on School Mathematics (UICSM) who received partial funding.

Curriculum discussions about the “new math” dominated the early part of the period, 1958 -2002. This came about because the Post-War curriculum was considered to be most unsuitable in a time of technological development. While there was a recognition of a need for change in the school mathematics curriculum, many in the mathematics education community were not sure that the “new math” was the right direction. At first the “new math” seemed to have been well received, so much so that Walmsley believes that for the most part it was positively presented and received.¹⁰⁵ However several other historians argue that this was not the case and that the “new math,” if not a total failure as some claimed, certainly was not very widespread. The opposition to the reform curriculum was based in part on what some called its highly abstract nature. However some writers believe that many teachers were not properly trained and in fact did not fully understand the “new math” themselves.

The discontent over the “new math” created a severe reaction and a call to return to basics. Thus the “back to basics” movement developed in the early 1970s, but not everyone was happy with the mathematics curriculum. There seemed to be much uncertainty about its direction at that time. To some writers, mathematics education appeared to be in a state of limbo and groped for a clearer focus as the mathematics education community sought for a sense of direction.¹⁰⁶ This sense of a lack of direction created a perfect opportunity for the NCTM. Thus the NCTM found itself as the leader in the mathematics education community and did not

105. Walmsley, *A History of the “New Mathematics” Movement*, 29.

106. Fey and Graeber, “From the New Math,” 549

disappoint as it created standards for mathematics teaching and learning. So comprehensive were these standards that the federal government and many states found them useful as models for their own standards.

As a matter of fact since the most recent re-authorization of the ESEA, the NCLB, implementation of state standards is mandatory for federal funding and it is tightly monitored. The local education authorities (LEAs) were made responsible for the monitoring of the standards enshrined in the NCLB. Hence the task of ensuring that schools maintain the standards required of them by the new law fell to the states and other local authorities. It remains to be seen whether this tough new law will bring about the much needed improvement in mathematics education.

CHAPTER THREE

MIDDLE SCHOOL MATH IN NEW YORK CITY 1958-1975

Introduction

In Chapter Three I first consider the Post War mathematics curriculum. I provide a brief overview of middle school mathematics education in New York City in the period between World War II and the National Defense Education Act, 1958. During this period much discussion took place in New York City and throughout the country regarding the place of mathematics in the school curriculum. The important question then was: how much mathematics do the pupils need? In an effort to shed some light on the debate surrounding this question I briefly examine the mathematics curriculum offered to the students in the junior high schools.

In this chapter I also look at the advent of the “new math” as it coincided with the renewed efforts of the New York City Board of Education to improve the performance of the middle grade students in mathematics.¹ I further look at the curriculum development efforts of the Board of Education and the impact that the new curriculum development groups such as the School Mathematics Study Group (SMSG) and the Madison Project had on it. While those two groups were not the only ones involved in curriculum development, they were among the first to look at “new math” curricula for the elementary and middle grades.

I also study the effects of the “new math” on the middle school mathematics curriculum in New York City in the late 1950s and early 1960s. Consequently, I analyze several curriculum documents from the period. For example, the *Course of Study, Mathematics 7-8-9*, the

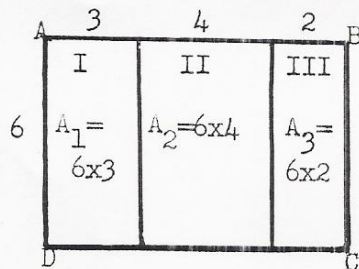
1. This term was given to any one of the new mathematics curriculum developed in the 1950s and 1960s by the various curriculum writing groups.

Mathematics 9th Year syllabus, and the *General Mathematics 9th Year* syllabus are all evaluated. These documents gave a clear indication of how pervasive (or not) the “new math” was in New York City.

The greater focus of the discussion in the early part of the chapter is on the ninth grade; this is relevant as the ninth grade was still part of the middle grades during this period. Hence, greater emphasis was placed on developing the most appropriate curriculum for this grade because it was viewed as the one which prepared the student for high school. I examine this perspective closely, especially as the ninth grade curriculum was divided into two: a General Mathematics 9th Year curriculum for one group of students and a Mathematics 9th Year curriculum for another group.

The separation of the mathematics curriculum into General Mathematics 9th Year and Mathematics 9th Year could be seen as an attempt to track the students into areas of study that were considered to be most suitable for them. As I will illustrate, the Mathematics 9th Year program was designed for students with the better ability. Some influence of the “new math” was evident in this program. For instance the distributive property (a “new math” topic) was modeled by finding the area of a rectangle as shown below

Elicit that the distributive property may be applied to three or more addends, as illustrated.



$$A = 6 \times (3 + 4 + 2) = 6 \times 9 = 54 \text{ square units}$$

$$A = (6 \times 3) + (6 \times 4) + (6 \times 2)$$

$$18 + 24 + 12 = 54 \text{ square units}$$

I also discuss the emphasis on fractions in the 9th grade curriculum. The Mathematics 9th Year program used inputs from the “new math” in order to develop the concept of fractions. The discussion highlights the fact that while one group of students was felt able to comprehend the new ideas, the other group of students was not. Hence the first group was fed more abstract material, while the second group was allowed to focus on computation. Notwithstanding the influence of the “new math” there was still this emphasis on fractions, but in this case for some students the focus was on the concept of fraction rather than on just the computation.

I also examine the shortage of mathematics teachers during the period and the Board’s attempts to deal with the problem. While there was an overall shortage of mathematics teachers in New York City, the situation was most acute in the junior high schools. The general view was that one reason for the shortage of mathematics teachers was that business and industry were

more attractive than teaching to mathematics majors because of the substantial salary difference.² I also discuss in this chapter the efforts of the Board to attract teachers from outside of New York. A novel idea to try to relieve the overall teacher shortage was the program, “Operations Reclaim” which was started during this period. This program was designed to bring displaced African-American teachers from the South to teach in New York City. Only a few of them, however, taught mathematics, the area in which the need for teachers was the greatest.

Post War Education in the US

In the period immediately after the war and up to the launch of Sputnik there appeared to be a common theme running through the United States, that is, that the country had gone soft on education and there was a lack of rigor in mathematics education. Hence the fear was that the country was setting itself up for shortages in areas that were essential to national security.³ The general consensus of education historians is that the public believed that the Soviet Union had overtaken the United States in the space race and that did not auger well for the future security of this country.

At that time there was much debate as to the extent of federal involvement in education. It was felt by some that State and local authorities were quite competent to develop and provide the training that the students needed. Others believed that the curriculum was too soft and the federal government should intervene to ensure that the nation’s youth were educated so that they could help to maintain the nation’s military superiority. Arthur Bestor and Admiral Hyman

2. Henry M. Levin, “Solving the Shortage of Mathematics and Science Teachers,” *Education Evaluation and Policy Analysis* 7, no. 4 (1985): 374.

3. Lappan and Wanko, *The Changing Roles*, 903.

Rickover felt that education fell under the umbrella of national policy particularly in time of war, “cold or otherwise”, and was therefore open to federal assistance.⁴

A publication by the Board of Education, *Course of Study in Mathematics, 1940*, made it abundantly clear that there were concerns about the content of the mathematics curriculum. It complained about what was considered a disproportionate emphasis that was often placed on high skill in computation and that “this results in a great waste of time and effort as well as failure to achieve the higher aims of mathematics teaching.”⁵ It is therefore obvious that discussions about the reform of the middle school mathematics curriculum in New York City were being held even before World War II.

As a result of all this debate in the country the National Science Foundation (NSF) was set up by the federal government in 1950 with a small appropriation of \$225,000 for the specific purpose of developing a national policy for the promotion of basic research and education in the sciences.⁶ The concern with the state of education and financial assistance from the NSF resulted in many new curriculum projects being started in an effort to upgrade mathematics and science education in the country.

There was a renewed concern with mathematics education after the War and some historians saw it as a reaction against the postwar mathematics curriculum which was based on life adjustment.⁷ It was criticized by Kliebard, who disliked it, and Diane Ravitch, to whom the

4. Lappan and Wanko, *The Changing Roles*, 901.

5. Board of Education, *Course of Study in Mathematics*, New York City Board of Education, 8, New York City Municipal Archives, Series 667 VII.

6. NCTM, *A History of Mathematics Education*, 1970, 74.

7. Garrett and Davis, *A Time of Uncertainty and Change*, 513.

postwar curriculum was “unabashedly anti-intellectual.”⁸ The supporters of life adjustment saw it as a curriculum that was designed to meet the needs of the nation’s youth and as such they advised that the mathematics curriculum should concentrate on practical problems, “such as consumer buying, installment buying, insurance, taxation, and home budgeting” for the students in the life adjustment program. Courses in algebra, geometry, and trigonometry should be reserved for the college-bound.⁹

The syllabi for the junior high school were divided into Grades 7A, 7B, 8A, 8B, 9A, and 9B. The syllabi for grades 8A, and 8B are selected to show what the typical syllabus looked like. The 8A and 8B syllabi were each divided into arithmetic, informal geometry, and algebra. The grade 8A and 8B arithmetic courses of study are shown in Table 3-1 below.

8. Kliebard, *Changing Course*, 133; Ravitch, *Left Back: A Century of Failed School Reforms*, 327.

9. Ravitch, *Left Back: A Century of Failed School Reforms*, 329.

Table 3-1
Course of Study-Arithmetic

Grade 8A	Grade 8B
Review of Fundamental Operations	Borrowing money: personal, business;
Oral and written problems involving integers, common and decimal fractions, fractions, and percentage concerning the following topics and activities:	Metric system at home and abroad
Thrift in the family; family income and expenses; saving banks; use of interest tables;	Foreign money: foreign money orders, foreign exchange
Safeguarding the family—life, health, and property insurance.	

Source: New York City Board of Education, Course of Study in Mathematics, 1940

The arithmetic syllabi for both grade 8A and 8B (Table 3-1) could be described as the classic life adjustment curriculum. As indicated earlier the emphasis was on practical problems such as consumer buying, installment buying, insurance, taxation, and home budgeting. This is what Kliebard saw when he claimed that life adjustment education depended on the basic tenet of social efficiency, which was that the principal function of schooling should be the adjustment of students to the social world in which they live.¹⁰

10. Garrett and Davis, *A Time of Uncertainty and Change*, 511.

Table 3-2
Course of Study-Informal Geometry

Grade 8A	Grade 8B
Triangles as found in the environment	The triangle: its properties
Construction	Area of the circle
Finding perimeter	Volume: cube, rectangular solid, cylinder
Classification and notation	Symmetry: design in nature; in applied arts
Finding area	

Source: New York City Board of Education, Course of Study in Mathematics, 1940

The informal geometry syllabus for grade 8A shown in Table 3-2, required the following outcomes: a) familiarity with the following concepts, triangle, isosceles triangle, scalene triangle, equilateral triangle, sides, vertex, vertex angle, base angle, acute triangle, right triangle, and obtuse triangle; b) ability to construct triangles when two angles and the included side or two sides and the included angle or three sides are given; c) ability to find the perimeter of a triangle; d) recognition of the importance of the triangle in building, in mechanical drawing, and in design; e) ability to find the area of a triangle. This syllabus, as can be seen, focused only on the triangle.

The 8B syllabus focused on some other areas. The desirable outcomes were a) ability to find the area of a circle; b) ability to find the volume of a cube, a rectangular solid, a cylinder; c) recognition and appreciation of symmetry; d) skill in design and in construction based on symmetry. Just as the 7B syllabus built on the 7A syllabus so the 8A syllabus built on the work

of the 8A syllabus. While in the 8A syllabus students worked with the triangle, in the 8B syllabus they worked with other geometric figures.

Table 3-3
Course of Study-Algebra

Grade 8A	Grade 8B
The formula in meaningful situations	Positive and negative numbers
Meaning and use of algebraic symbols	The exponent
Problems involving simple equations	

Source: New York City Board of Education, Course of Study in Mathematics, 1940

Figure 3-3 shows the algebra used in grades 8A and 8B. For these the desirable outcomes were, Grade 8A, a) understanding and use of algebra as a generalized language for expressing mathematical ideas, principles, and relationships; b) understanding that letters may be used to represent numbers; c) ability to find the numerical value of one letter in a formula after proper substitution; d) ability to translate an algebraic expression into a verbal statement; ability to translate simple verbal problems into equation form; e) ability to solve problems within the scope of the grade; f) an understanding of the use of the formula in everyday life. For 8B, the desired outcomes were: a) understanding of the meaning of negative numbers; b) ability to read and interpret simple graphs; c) ability to understand and use signed numbers; d) ability to use and understand the vocabulary related to topics of the grade.

However, both the mathematics that was being taught and the method of teaching it came seriously into question when New York City, along with the rest of the nation, had to re-examine its mathematics course content and its teaching methods in light of 1) the poor performance in mathematics of the military recruits, and 2) the perception brought about by Sputnik that the United States was technologically inferior to the Soviet Union. Changes in the mathematics

curriculum brought about by events such as Sputnik are viewed by some mathematics education historians as not occurring in isolation. They see a recurring pattern.

Notwithstanding the debate over the place of mathematics in the school curriculum it remained as a necessary part of the basic curriculum; and by the late 1950s, immediately after Sputnik, became a very important part of the curriculum. The New York City school system recognized the importance of mathematics in the school curriculum; and, as will be discussed later in this Chapter, the curriculum development division prepared a new course of study in mathematics for the junior high school students in 1958.

A New Course of Study for Grades 7, 8, and 9

Just about the time when the various curriculum development groups were busily engaged in developing the “new math” curricula the New York City Board of Education was preoccupied with the unsatisfactory performance of their middle school students in mathematics. Therefore, with the aim of improving the content and pedagogy of mathematics in New York City, the Junior High School Division distributed what was called “cycles” of Mathematics 7, Mathematics 8, and Mathematics 9 to all schools in 1958. These “cycles” contained detailed explanations of the materials and methods that were to be used for teaching every topic in a new course of study which was then being prepared.¹¹

In January, 1959, the newly revised course of study for grades 7, 8, and 9, was formally adopted to be used in the Junior High Schools.¹² This new Course of Study was an integral part of the entire K-12 mathematics program. It continued the developmental program which was

11. New York City Board of Education, *Mathematics- Changes in the Mathematics Program*, New York City Board of Education, 1962

12. New York City Board of Education, *Mathematics- Changes in the Mathematics Program*, 1962

presented in the Course of Study in *Mathematics: Grades K-6*, and it laid the foundation for the program in Grades 10-12. This course of study outlined the philosophy, source, and materials in mathematics that were to be taught in the Junior High Schools. The work which was being done by the Curriculum Division of the Board of Education could also be viewed as a local response to the national concern with the state of mathematics education in the country at that time.

The new curriculum received the approval of the Superintendent of Schools, Dr. John Theobald, who saw the development of the new courses of study to completion, although it was started during the previous Superintendent's administration.¹³ Dr. Theobald was appointed to the post on September 1, 1958, at which time he succeeded Dr. William Jansen, who had served as New York City Schools Superintendent since 1947. Dr. Theobald was Deputy Mayor of New York City at the time he was selected to head its school system.¹⁴ His new challenge was to use the limited funds made available to him by the Board of Estimate to provide the best possible education, in the most suitable environment, for the children of the city.¹⁵ Although this would have been a daunting task for another person, he did not shirk the task because of his several years experience in the service of the city.

Dr. Theobald continued the program started by his predecessor, and in 1960 a teacher's manual representing a modernization of the seventh year cycle, *Mathematics Grade 7*, prepared by the Junior High School Mathematics Curriculum Committee, was adopted.¹⁶ Another product of the curriculum committee, a teacher's manual for the 8th grade, *Mathematics Grade 8*, was

13. Dr. Theobald succeeded Dr. William Jansen who served as Superintendent of Schools from 1947 to 1958.

14. Buder, Theobald Chosen City School Head, *New York Times*, December 12, 1957

15. The Board of Estimate prepared the budget for all the city agencies and then granted each one an allocation.

16. New York City Board of Education, *Mathematics- Changes in the Mathematics Program*, 1962

distributed to the junior high schools in May 1962.¹⁷ Some new topics were introduced in these programs, making this one of the first efforts by a major city to introduce selected topics from modern mathematics into the official curriculum. It was a clear indication that the influence of “new math,” albeit on a very limited scale, had impacted the development of new curricula in New York City.

At the end of July, 1960 Superintendent Theobald presented his annual report to the public for the 1958-59 school year. According to the report the New York City school system had made “considerable gains in its efforts to improve educational programs and services.”¹⁸ The report indicated that in mathematics, New York City sixth graders were three months ahead of pupils elsewhere. It also claimed that they had three months advance on the achievement of their 1950 counterparts. According to the report this advance resulted from the fact that the schools had given increased emphasis to assisting pupils who needed to overcome the difficulties that they had with mathematics. Unfortunately, the Superintendent did not present any evidence to support his claims. As a result there was no way of verifying the “considerable gains” which he reported.

While there were some concerns regarding the “new math” vs. the traditional mathematics in New York City in the late 1950s and early 1960s, the major concern appeared to be the separation of the curriculum into Mathematics and General Mathematics. The students were tracked into the college-bound who had used the Mathematics, and the non college-bound who had used the General mathematics curriculum.

17. New York City Board of Education, *Mathematics- Changes in the Mathematics Program*, 1962

18. Buder, Theobald Notes School Progress, *New York Times*, August 1, 1960

The success of the work of the curriculum development committee and other policy-makers in the junior high school mathematics education community in New York City has to be viewed in light of the social and economic conditions of the students at the time. A large proportion of the middle school population was Black and Puerto Rican.¹⁹ These were children of newcomers to the city who were, to a large extent, unlearned themselves. They could not provide proper educational support for their children and therefore the job of the curriculum planners was made that much more difficult. The mathematics curriculum had to be designed to meet the special needs of these children. The General Mathematics program was used for this purpose. As Deputy Superintendent Loretan said at the time, “General Mathematics 9th Year is an alternative course specially prepared for students whose needs would not be served by the Mathematics 9th Year.”²⁰

The superintendent of schools was quite pleased with the work done in the schools and with the progress of the mathematics curriculum committee who worked diligently to reform the junior high school mathematics curriculum. There were, however, other areas in the school system that remained impervious to reform initiatives. As a result, notwithstanding his efforts, Dr. Theobald failed to bring about the necessary reforms that were required to improve the school system. Therefore, while the school system was imperfect when he took over, it did not make the improvement that was hoped for during his tenure.²¹ This perceived lack of improvement brought heavy criticism from his many detractors.²² The continuous criticism from

19. Ravitch, *The Great School Wars*, 2000, 242.

20. Loretan, Foreword to General Mathematics 9th Year, Board of Education of the City of New York.

21. The New York Times, Dr. Theobald Departs,” *New York Times*, May 25, 1962.

22.” Dr. Theobald Departs,” *New York Times*, May 25, 1962

his detractors about his overall performance eventually took its toll and he was forced to retire before completing his term.

His replacement, Calvin Gross, made certain that the program of curriculum development continued. As a result the next program to be developed was the General Mathematics 9th year. This was done by the 9th-Year General Mathematics Curriculum Committee, which prepared a course of study and a detailed teacher's manual.²³ At first, during 1960-62, only five units were prepared: Statistics, Geometry, Graphs, Indirect Measurement, and Equations. These were completed early and used experimentally by selected pupils in all junior high schools in the city.²⁴ However by 1964-65 three more units were added: Direct Measurement, Consumer Mathematics, and Contemporary Mathematics-Other Number Bases.²⁵

The General Mathematics 9th Year was prepared for the students who were considered to be uncomfortable with mathematics. It was believed that those students should find experiences that would challenge their interest in the General Mathematics course. To the curriculum planners it had become evident over the years that no single mathematics course of study in the 9th year could adequately serve the needs of all pupils in this grade.²⁶ Detailed instructions were given to assist teachers in the use of the syllabus. For example, they were advised to study carefully all the chapters in preparation for use in the class so that they could amplify the practice material suggested for each topic with additional material from various textbooks.

23. New York City Board of Education, *Mathematics- Basic Changes in the Mathematics Program*, 1962.

24. New York City Board of Education, *Mathematics- Basic Changes in the Mathematics Program*, 1962.

25. New York City Board of Education, *General Mathematics 9th Year*, New York City Board of Education, Curriculum Bulletin No. 16, 1965.

26. New York City Board of Education, *General Mathematics 9th Year*, New York City Board of Education, Curriculum Bulletin No. 16, 1965.

The primary objectives of the program as outlined in the *Course of Study in Mathematics:*

Grades 7, 8, and 9 were to help pupils:

Understand mathematics as a unified whole by perceiving interrelationships among concepts of mathematics and among fields of mathematics;

Understand and appreciate mathematics as part of their cultural heritage by finding out the part it plays in the progress of civilization;

Appreciate mathematics as an indispensable tool in the development of a technological society;

Realize that mathematics is a social tool by becoming aware of quantitative aspects of problems involved in everyday living;

Continue to develop concepts in, and understanding of, fundamental operations;

Maintain and increase skill in the fundamental operations used in the solution of problems

Continue to develop mathematical power by solving problems

Explore the various branches of mathematics for the development of individual interests and abilities.²⁷

In the school year 1958-59, an experiment was undertaken by the Junior High School Division to determine whether brighter students could learn much more, both in extent and in depth, than was expected of them in the regular course of study.²⁸ The result of this experiment was to be used as a guide in preparing special curriculum materials in mathematics for the 3-YR SP (3 year special progress) classes. The course of study which was eventually developed for these special progress classes included topics from modern mathematics: Sets, Systems of Numeration, Properties of Operations, and Inequalities. These topics were introduced at logical points within the framework of the regular mathematics course of study. The publications of the School Mathematics Study Group (SMSG) of Yale University were particularly useful in assisting the curriculum committee. SMSG and the Madison Project were two “new math” curriculum development groups that were instrumental in producing curriculum material for Junior High schools.

27. Theobald, *Course of Study Mathematics Grades 7-8-9*, Board of Education, City of New York, 1959, New York City Municipal Archives, Series 667 VII.

28. New York City Board of Education, *Mathematics- Basic Changes in the Mathematics Program*, 1962.

The introduction of the new topics was an attempt by policymakers to bring about some type of reform in the New York City junior high school mathematics curriculum. The intention was to reduce the emphasis on whole number arithmetic and to focus on teaching mathematics in a way that helped students to understand and appreciate the subject. However this program was designed for only a small group of the more advanced students who were considered capable of benefitting from such a program. These students in the 3 year Special Progress classes were the *crème de la crème*. Those deemed as having little less ability were allowed to take the Mathematics 9th Year course, while those with the least ability were given the General Mathematics 9th Year course.

The syllabus of the General Mathematics 9th Year Course of study was different from that of the Mathematics 9th Year Course. The General Mathematics 9th Year syllabus identified the aim of that course as being able to contribute to the general development of the student through:

1. An appreciation and understanding of the application of mathematical techniques and processes.
2. Understanding the application of mathematics in the individual's relationship to government, industry, science, insurance, banking, personal accounting, and in the use of instruments of measurement, graphs, tables and charts.
3. Maintenance in each pupil of competence in number concepts, accuracy and speed in fundamental operations, and in problem solution. (Arithmetic is stressed in each unit.)
4. Development of habits of accuracy, neatness, orderliness, and systematic procedures, and an attitude of judgment based on facts.²⁹

It is important to recognize that in the General Mathematics 9th Year curriculum arithmetic was stressed throughout, and this remained very much the traditional curriculum;

29. New York City Board of Education, "General Mathematics 9th Year," New York City Board of Education January, 1965, 2.

while on the other hand some new topics adopted from “new math” were introduced in the Mathematics 9th Year curriculum. Too much should not be made of the introduction of new topics, however, as arithmetic was still stressed a great deal in this curriculum, even though there were some changes made to it. It was clearly stated in the course of study that in grade 9 “Arithmetic processes will be used again and again as a basis for the development of fundamental operations with algebraic expressions. For example, the distributive law which is used in multiplication of arithmetic numbers is used for the development of understanding of addition of monomials”³⁰ The problems below (Figures 3-1 and 3-2) selected from Mathematics 9th Year are typical of the type referred to above. In these problems a conceptual method is used to demonstrate the distributive property of multiplication over addition.

30. New York City Board of Education, “Course of Study,” Curriculum Bulletin No. 3, 1959, 14, New York City Municipal Archives Series 667 VII.

VIII. The Distributive Property of Multiplication Over Addition for the Set of Signed Numbers

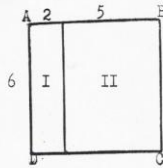
A. Suggested Procedure

1. Review the distributive property for the numbers of arithmetic.

$$\begin{aligned} \text{a. } 3 \times 35 &= 3 \times (30 + 5) \\ &= (3 \times 30) + (3 \times 5) \\ &= 90 + 15, \text{ or } 105 \end{aligned}$$

$$\begin{aligned} 8 \times 4\frac{1}{2} &= 8 \times (4 + \frac{1}{2}) \\ &= (8 \times 4) + (8 \times \frac{1}{2}) \\ &= 32 + 4, \text{ or } 36 \end{aligned}$$

b. Pose problem: How can we find the area of this rectangle?



Method 1

$$A = w\ell, \text{ where } w = 6 \text{ and } \ell = 2 + 5$$

$$A = 6(2 + 5) = 6 \times 7 \text{ or } 42 \text{ square units}$$

Method 2

$$A = \text{sum of areas of rectangles I and II}$$

$$A = (6 \times 2) + (6 \times 5) = 12 + 30 \text{ or } 42 \text{ square units}$$

Have pupils observe that both methods give the same result because

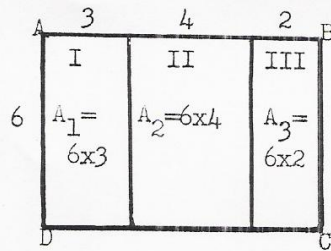
$$6(2 + 5) = (6 \times 2) + (6 \times 5)$$

Source: New York City Board of Education,
Mathematics 9th Year, 1966

Figure 3-1

The second problem, also taken from *Mathematics 9th Year*, is a little more difficult than the first. Whereas in the first problem the students are required to apply the distributive property to only two addends, in the second problem they are required to apply it to three addends.

Elicit that the distributive property may be applied to three or more addends, as illustrated.



$$A = 6 \times (3 + 4 + 2) = 6 \times 9 = 54 \text{ square units}$$

$$A = (6 \times 3) + (6 \times 4) + (6 \times 2)$$

$$18 + 24 + 12 = 54 \text{ square units}$$

Source: New York City Board of Education,
Mathematics 9th Year, 1966

Figure 3-2

As indicated by some of the word problems in the syllabus, the General Mathematics 9th year course, on the other hand, appears to be very basic. These basic problems remained in the traditional curriculum even though that was the period when curriculum groups like the School Mathematics Study Group (SMSG), the Madison Project, the University of Illinois Committee on School Mathematics (UICSM), the University of Maryland Mathematics Project (UMMP), and many other such curriculum preparers were busy developing new mathematics curricula with the hope of improving the standard of mathematics education in the United States.

This syllabus clearly indicated that it was the belief in some quarters that not all students were able to benefit from the new curriculum. Those students were thought to be unable to reach abstract generalizations quickly and were provided more experiences with concrete materials and

diagrammatic representation to develop an understanding of mathematical principles.³¹ Hence, programs such as the general mathematics were designed especially for such students. These students were therefore tracked away from the “new math” to more practical material that was thought to be suitable for them.

According to the introduction to the 9th year syllabus, the General Education program of which the 9th year was a part was meant to give the individual an understanding of “the world in which he lives in its many quantitative aspects.”³² According to the syllabus, then, the program was designed to develop those concepts and tools which concern the phases of living which require quantitative and spatial thinking. It was further claimed that general mathematics as defined in the program contained elements of arithmetic, algebra, geometry and trigonometry and that these topics contributed to the students’ understanding of the world.³³

These basic problems were supposedly designed in keeping with a major objective of the program, which was “the improvement of the pupil’s ability to understand and use those arithmetic skills which he will need to take his place as a self sustaining citizen in the world of today and tomorrow.”³⁴ To achieve this, several exercises were provided in the use of fundamental skills throughout the syllabus. These exercises were based, in many cases, on real life situations, depending on the students’ level of maturity. Other aspects that were given consideration were what the introduction termed “non-computational mathematics.” Some of these were: the appreciation of the approximate nature of measurement, the recognition and appreciation of geometric forms in his environment, and the ability to read and interpret graphs

31. “Course of Study Mathematics Grades 7-8-9,” Board of Education, City of New York, 1959.

32. “General Mathematics, 9th Year,” Board of Education, 1965, 1.

33. “General Mathematics, 9th Year,” Board of Education, 1965, 1.

34. “General Mathematics, 9th Year,” Board of Education, 1965, 2.

and charts.³⁵ It was believed by the curriculum developers that these formed a necessary background of mathematical knowledge for all students.

The traditional mathematics curriculum in the 1950s, very much like the rest of the school curriculum, was based on Life Adjustment education. It was not unexpected, therefore, that problems in the General Mathematics 9th Year would be based on that concept, clearly indicating the influence of Life Adjustment on the curriculum. Such a problem is shown in Figure 3-3 below.³⁶ The problem was apparently intended to prepare students for work as payroll clerks or bookkeepers. It was part of what was referred to as Consumer Mathematics in the General Mathematics 9th Year syllabus. This section was 11% of the overall syllabus. It is surprising though that Consumer Mathematics was not a dominant part of the syllabus in view of the fact that, in the late 1950s, many secondary school students were still being prepared to go directly into the workplace.³⁷

35. "General Mathematics, 9th Year," Board of Education, 1965, 2.

36. "General Mathematics, 9th Year," Board of Education, 1965, 2.

37. For J. Butler in the problem below the number in the \$10 column should be 5. Also, the total of the "Take Home Pay" column should be \$256.16.

6. Take Home Pay

- a. Assuming a 40 hour work week, compute the "Gross Salary", "Social Security Tax" at 3%, and then the "Take Home" pay in each of the cases below. Have the pupils enter the results of their computations in the blank spaces.

Name	Hourly Wage	Total Wage	Social Security Tax	Withholding Tax	Take Home Pay
J. Butler	\$1.60			\$9.40	
D. Perez	\$1.28			\$7.10	
P. Davis	\$1.20			\$6.80	
J. May	\$2.20			\$13.70	
T. Green	\$1.50			\$8.70	

- b. In the above example the "Take Home" pay was established.

- 1) Find the total "Take Home" pay for all the employees.
- 2) The payroll clerk was sent to the bank to get the money to pay the employees.

He returned with the following bills and coins:

Number	Denomination
2	Hundred dollar bills
1	Fifty dollar bill
1	Five dollar bill
1	One dollar bill
1	dime
1	nickel
1	penny

Source: New York City Board of Education,
General Mathematics 9th Year, 1966

Figure 3-3

- 3) Could he pay the employees using the money he brought back from the bank in the denominations above? Explain.
- 4) How could he find the least number and denominations of bills and coins necessary to correctly fill the pay envelopes of each employee? (currency breakdown)
- 5) Have pupils fill in the following chart. Check their work.

Name	Take Home Pay	Denominations							
		\$10	\$5	\$1	50¢	25¢	10¢	5¢	1¢
J. Butler	\$52.68	1	0	2	1	0	1	1	3
D. Perez	42.56								
P. Davis	39.76								
J. May	71.66								
T. Green	49.50								
Totals	\$256.15								

- 6) This time the payroll clerk used a memo such as the one below before going to the bank.

What would be the advantage of using such a memo?

Fill in the memo.

Currency Memo		
Denomination	Number	Total Value
\$10		
\$ 5		
\$ 1		
50¢		
25¢		
10¢		
5¢		
1¢		

- 7) Find the sum of the "Total Value" column. .
With what figure should this sum agree?

Source: New York City Board of Education,
General Mathematics 9th Year, 1966

Figure 3-4

The problem shown in Figure 3-3 is a good example of the influence of Life Adjustment on the middle school mathematics curriculum in the 1950s. It is a problem that focused only on arithmetic, and it involved a step by step procedure without any need for conceptual understanding. Such problems required very little abstract thinking on the part of the student. For example, in the case of Mr. J Butler, the student calculated his take home pay by multiplying

the hourly rate by the number of hours he worked, then subtracting from it the social security contribution and his withholding tax.

Another test of the student's skill was for the student to determine how many bills of each denomination were needed for Mr. Butler's pay. The third test of the student's skill was to determine how many bills and coins were needed for the entire payroll (Figure 3-4). Hence the challenges to the student were the knowledge of elementary arithmetic, the memorization of the procedure, and the exercise of great care in following the necessary steps. It was problems of this type which led to the belief that the mathematics curriculum was unsuitable and caused condemnation of the curriculum by the "new math" advocates.

Teaching the Concept of Fractions

The Mathematics 9th Year program used inputs from the "new math" in order to develop the concept of fractions. This approach was taken because it was thought that this group of students was able to comprehend the new ideas. Unlike the students in the General Mathematics 9th year program, these students were fed more abstract material. Notwithstanding the influence of the "new math", however, there was still this emphasis on fractions; but in this case the focus was on the concept of fraction rather than on just the computation.

In the examples shown below in Figure 3-5 (p69) and Figure 3-6 (p70), attempts are made to develop a better conceptual understanding of fractions. The area model of multiplying fractions was therefore introduced before the use of the regular multiplication algorithm. The area model, sometimes called the region model, is one of three models that have been used to help students develop a conceptual understanding of fractions. The other two are the length model and the set model. These models are used to develop the idea that a fraction is a

relationship between a part and a whole, and by this means help students to make that connection.³⁸ This idea is very well demonstrated in the above mentioned examples.

This emphasis on conceptual understanding is further evidence of the influence of the “new math” on the mathematics curriculum. Commenting on the new content introduced by SMSG, Joseph Payne said that they changed his classes dramatically.³⁹ He was specifically referring to the properties of closure, identity, commutativity, associativity, distributivity, and inverse operations. He also felt that they, along with place value, provided the structure for explaining the way numbers were operated on and the way algorithms were done.⁴⁰ Although the classes in New York City did not change dramatically, the acceptance of some new content did foster new mathematical thinking and learning by both students and teachers. The example in Figure 3-6, taken from Mathematics 9th Year, also fully demonstrates this even though the application relates mainly to the commutative principle.

The Mathematics 9th Year syllabus advised how to teach fractions along with the various mathematical properties that were previously discussed. To further provide proper guidance for the teacher these mathematical properties were discussed in detail. The discussion of each mathematical property was accompanied by some examples of its use with fractions for the teacher to model to the pupils. The example in Figure 3-6 is one such model. All these properties were introduced into the mathematics curriculum as a result of the influence of the “new math.” As a matter of fact they were specially introduced by Ed Begle and his SMSG.⁴¹ This clearly

38. Van de Walle, *Elementary and Middle School Mathematics*, 2001, 209.

39. Payne, “The New Math,” 561.

40. Payne, “The New Math,” 561.

41. Payne, “The New Math,” 561.

indicated that some elements of the “new math” did find their way into the traditional curriculum and did bring about some changes to it.

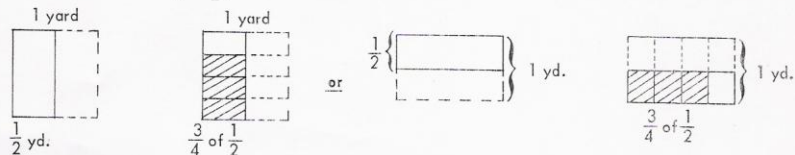
MULTIPLICATION AND DIVISION

MULTIPLYING FRACTIONAL NUMBERS: COMMON FRACTIONAL FORM

Problem: Elsie had $\frac{1}{2}$ of a yard of denim. She used $\frac{3}{4}$ of the material to make a tote bag. How much of the material was used? $\frac{3}{4}$ of $\frac{1}{2} = n$

Children draw a diagram to show $\frac{1}{2}$ yard of material. Some children may need to use experience materials.

How would you show $\frac{3}{4}$ of $\frac{1}{2}$ yard of material?



Discuss the diagrams and the reasons for the divisions.

Children find $\frac{3}{4}$ of $\frac{1}{2}$ by finding $\frac{1}{2}$, dividing the $\frac{1}{2}$ into 4 equal parts, and taking 3 of those equal parts.

Discuss the size of each part. What is $\frac{1}{4}$ of $\frac{1}{2}$? ($\frac{1}{8}$) What is $\frac{3}{4}$ of $\frac{1}{2}$? ($\frac{3}{8}$)

Children solve: $\frac{3}{4}$ of $\frac{1}{2} = \frac{3}{8}$

Problem: $\frac{4}{5}$ of a cake was left after lunch. $\frac{2}{3}$ of that was used for snacks. How much was eaten at snack-time? $\frac{2}{3}$ of $\frac{4}{5} = n$

Children draw diagrams to show $\frac{4}{5}$, then $\frac{2}{3}$ of $\frac{4}{5}$.



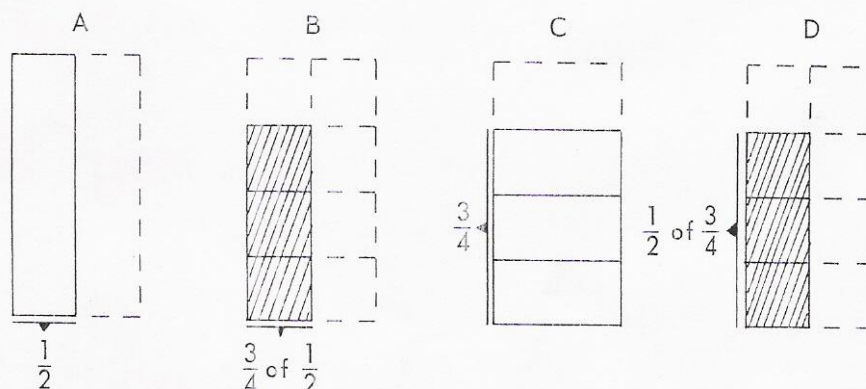
Source: New York City Board of Education,
Mathematics 9th Year, 1966

Figure 3-5

Applying the Commutative Principle

Problem: How does $\frac{3}{4}$ of $\frac{1}{2}$ compare with $\frac{1}{2}$ of $\frac{3}{4}$

Children draw diagrams for each situation.



Source: New York City Board of Education,
Mathematics 9th Year, 1966

Figure 3-6

In the first problem above, (Figure 3-5) the idea is to help students develop the concept of what it means to find $\frac{3}{4}$ of $\frac{1}{2}$. In this case the area model is used to achieve this objective. Proponents of the “new math” argued that it is only when a concept is fully understood that the algorithm has meaning to students. The problem follows this idea by first using a model (the area model) to explain the concept, then modeling the traditional algorithm, $\frac{3}{4}$ of $\frac{1}{2} = \frac{3}{8}$. This clearly demonstrates the influence of the “new math” on the work of the Junior High School Mathematics Curriculum Development Committee. The second problem in Figure 3-5 was modeled in a similar manner.

In the third diagram, (Figure 3-6) the commutative principle is modeled for the students. They were encouraged to use this method to solve the two problems, $\frac{3}{4}$ of $\frac{1}{2}$, and $\frac{1}{2}$ of $\frac{3}{4}$, and then compare the results. The intention was to help them to understand why the result of $\frac{3}{4}$ of $\frac{1}{2}$ is the same as $\frac{1}{2}$ of $\frac{3}{4}$, even though they are conceptually two different problems. This aspect of

mathematical understanding was strongly stressed by the proponents of the “new math.” Influenced by this new thinking, the work of the Curriculum Development Committee focused on preparing material that helped the students in the academic mathematics classes to develop a better conceptual understanding of the subject.

When compared to the above approach the traditional method was extremely simple and basic. The traditional approach was not concerned with conceptual understanding but ensured that the student was competent in using the algorithm. Hence there was no reasoning to determine why $\frac{3}{4}$ of $\frac{1}{2}$ was the same as $\frac{1}{2}$ of $\frac{3}{4}$. Each was taught as a separate problem using the traditional method of multiplying across to obtain an answer of $\frac{3}{8}$. In this approach the major concern was to obtain the correct answer by properly using the algorithm that was taught. In the “new math” approach the major concern was the conceptual understanding by the student.

Another important feature that was emphasized by the “new math” is computational estimation. The long term goal of computational estimation is to be able quickly to produce an approximate result for a computation. In the problem $4\frac{1}{2} \times 3\frac{1}{3}$, shown below in Figure 3-7, a step by step method of computational estimation is modeled so that the students could see the approximate value of the solution before an attempt is made to solve it by using the standard computational method. In this case since $4\frac{1}{2}$ lies between 4 and 5, and $3\frac{1}{3}$ lies between 3 and 4, then by multiplying 4 by 3 we get 12, and by multiplying 5 by 4 we get 20. The computational estimate indicates therefore that the solution lies between 12 and 20 ($12 < n < 20$).

These problems illustrate the heavy emphasis on arithmetic in general, and fractions in particular, even up to the 9th grade. The one shown below is further evidence of this emphasis on arithmetic, although it is slightly more difficult than the previous ones. Here an example of the

multiplication of mixed numbers is introduced. Children are made to draw a rectangle of $4\frac{1}{2}$ units long by $3\frac{1}{3}$ units high. They then mark off a $\frac{1}{2}$ unit on the base and a $\frac{1}{3}$ unit on the height as shown in the diagram. The product of the two mixed numbers is found by using the concept of the area of a rectangle, i.e., base multiplied by height. In this instance the rectangle is divided into four parts with dimensions of 4×3 , $4 \times \frac{1}{3}$, $\frac{1}{2} \times 3$, and $\frac{1}{2} \times \frac{1}{3}$. The sum of the areas of these four parts is the area of the entire rectangle, which could have also been found by using the traditional algorithm, i.e. finding the product of the two mixed numbers.

It is evident that this is a geometrical approach to solving the problem. However, when the mixed numbers are separated into whole numbers and fractions and then multiplied independently, it may be considered an arithmetical use of the distributive property commonly used in algebra. The intention here was to demonstrate to the students that these three important branches of mathematics, arithmetic, algebra, and geometry, are linked. Further, the important fact that mathematical problems may be solved using any one of several different methods is also shown to the student.

The method adopted in the problem first demonstrates the “new math” ideas (Figure 3-7,p73), and then uses the traditional algorithm of converting mixed numbers to improper fractions and subsequently multiplying them as shown in Figure 3-8 (p74).

Figure 3-7

Problem: Anne was allotted land in the school garden, $4\frac{1}{2}$ ft. long and $3\frac{1}{3}$ ft. wide. What was the area of her strip of land?

$$4\frac{1}{2} \times 3\frac{1}{3} = n$$

Estimate: $4\frac{1}{2} > 4$ and $3\frac{1}{3} > 3$, therefore $4\frac{1}{2} \times 3\frac{1}{3} > 4 \times 3$

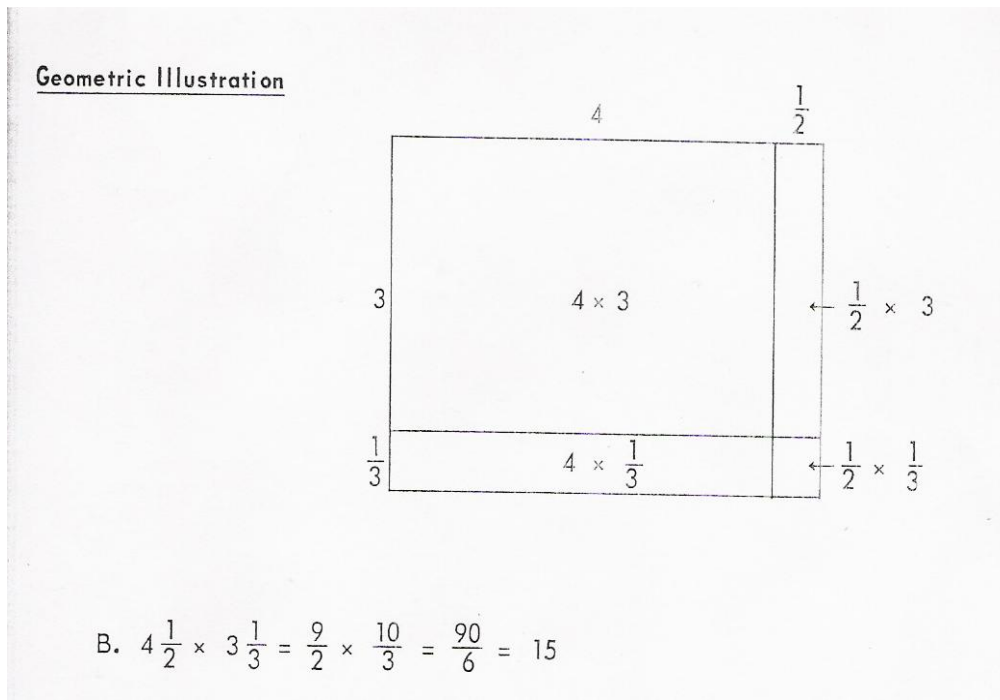
$$4\frac{1}{2} < 5 \text{ and } 3\frac{1}{3} < 4, \text{ therefore } 4\frac{1}{2} \times 3\frac{1}{3} < 5 \times 4$$

$$n > 12; \quad n < 20; \quad n \text{ will be between } 12 \text{ and } 20$$

Possible Methods of Solving:

$$\begin{aligned} \text{A. } 4\frac{1}{2} \times 3\frac{1}{3} &= (4 + \frac{1}{2}) \times (3 + \frac{1}{3}) \\ &= (4 \times 3) + (4 \times \frac{1}{3}) + (\frac{1}{2} \times 3) + (\frac{1}{2} \times \frac{1}{3}) \\ &= 12 + 1\frac{1}{3} + 1\frac{1}{2} + \frac{1}{6} \\ &= 15 \end{aligned}$$

Source: New York City Board of Education,
Mathematics 9th Year, 1966



Source: New York City Board of Education,
Mathematics 9th Year, 1966
 Figure 3-8

Curriculum Policy Differences in the 9th Year

The conceptual approach was emphasized in the Mathematics 9th Year curriculum -- as opposed to the General Mathematics 9th Year curriculum -- because the former program was designed for students who were considered to be more mathematically capable. The students who used the General Mathematics program did not have the benefit of the conceptual approach, since they were thought not to need the conceptual understanding. Figure 3-9 (p75) below is a very clear example of the type of work that was offered to the General Mathematics 9th Year students. This clearly indicates that there was some form of tracking system, perhaps unintended, designed by the Curriculum Development Division and approved and sanctioned by the New York City Board of Education.

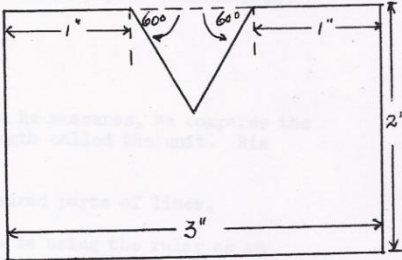
Figure 3-9

Shop work and the angle

1. Discuss with pupil the possible use of the angle in shop work.
 - a. carpenter's square for right angles
 - b. table legs set in at an angle
 - c. the V block
 - d. the angle of the cutting edge of a drill bit
2. Suggested practice
 - a. Making a V block

A block is 3" wide and 2" high. A 60° V cut is to be made at the center. Draw a diagram to demonstrate this operation.

 - 1) Have pupil draw a rectangle that is 3" long and 2" high.
 - 2) Have pupil mark off points 1" from each edge of block (see diagram)
 - 3) Measure an angle of 60° at each of these points.



Source: New York City Board of Education,
General Mathematics 9th Year, 1966

A circular issued to Superintendents, Principals, Directors, and Heads of Bureaus in April, 1966, further lends support to this view, as it provides a clear insight to the policy regarding students in the 9th grade mathematics classes. The main points of the policy statement were a) All students in the Ninth Year who are not programmed for the (academic) Ninth Year Mathematics course should be programmed for General Mathematics 9 to meet the present "one year in mathematics" requirement for the High School General Diploma; b) The course of study in General Mathematics 9 is developed in our New York City Curriculum Bulletin, 1964-65, No. 16, entitled, "General Mathematics 9;" c) In junior high schools, with Ninth Years, these two courses, "Ninth Year Mathematics and General Mathematics 9, are being taught. However, in some of the academic high schools, a commercially oriented arithmetic course is being taught in place of the General Mathematics 9 course; d) It is recommended that, as soon as is practicable, these schools change from the Business Arithmetic course to General Mathematics 9. A

suggested date is September, 1967; e) For students who are more than 2 or 3 years below grade in reading and in arithmetic computational skills, a modified General Mathematics 9 course should be offered, where, in smaller classes, more emphasis is placed on remediation.⁴²

The first policy statement instructed that all students who were not programmed for the academic 9th Year Mathematics course should be programmed for the General 9th Year course. Notwithstanding the fact that the General 9th Year course was very basic, those students were allowed to use it to fulfill the “one year in mathematics” requirement for the High School General Diploma. The General Mathematics 9th Year course could not, however, be used in the 3-year sequence in mathematics for the academic diploma. That sequence consisted specifically of 9th Year Mathematics, 10th Year Mathematics, and 11th Year Mathematics, or equivalent, i.e. one year of Intermediate Algebra and one term of Trigonometry.⁴³

Although both mathematics 9th Year courses were taught in the junior high schools, in some of the academic high schools with 9th grade classes a “commercially-oriented” arithmetic course was being taught in place of the General Mathematics 9th Year course. The circular recommended that these high schools change from the Business Arithmetic Course⁴⁴ to the General Mathematics 9th Year Course as soon as it was practicable. The suggested date for the change was September, 1967. This gave those high schools a little over a year to phase out the old program.⁴⁵ It was expected that the change to the General Mathematics 9th Year course

42. New York City Board of Education, “General Circular No. 17, 1965-1966,” April, 1965. (New York City Public Library, Microfilm ZAN-T5199).

43. New York City Board of Education, “General Circular No. 17, 1965-1966,” April, 1965.

44. It would have been very instructive to be able to examine the Business Arithmetic syllabus, however details of that syllabus is unavailable.

45. New York City Board of Education, “General Circular No. 17, 1965-1966,” April, 1965.

would cause some staffing problems so the schools were allowed to have the classes taught by Mathematics 9th Year teachers or Accounting teachers.

The General Mathematics 9th Year was a basic course for all students who were not capable of mastering the academic 9th Year program; and, in an effort to smooth the progress of those students, they were allowed the privilege of using it to meet the “one year in mathematics” requirement. Because of this they could also have used it as a terminal course. However, it was still hoped that students would see it fit to continue in their tenth year with other mathematics courses. The mathematics courses offered to those students in their tenth year were: General Mathematics 10th Year; Business Mathematics (which according to the circular was not the same as Business Arithmetic mentioned above); and Basic Applied Mathematics.⁴⁶

Curriculum Development in Grades 6, 7, and 8

So far only both 9th Year courses have been discussed. This is not to say that attention was not being paid to the grades 6, 7, and 8 curricula at that time. As a matter of fact, the grade 6 curriculum was being upgraded at the same time as the 9th year curriculum. This was made quite clear when Deputy Superintendent of Schools, Joseph Loretan, in his Foreword to *Mathematics Cycles Grade 6*, said that the material in that publication was prepared to meet the needs of teachers and supervisors to assist in upgrading the mathematics program in grade 6. He continued, “We must meet the challenge of the new directions and the awakened interest in mathematics. Let us continue to provide the background which will allow our students to move forward systemically”.⁴⁷ However, much has not been said about the 6th, 7th, and 8th grade

46. New York City Board of Education, “General Circular No. 17, 1965-1966,” April, 1965.

47. Joseph Loretan, Foreword in “Mathematics Cycles Grade 6,” New York City Board of Education, 1965.

curricula because the focus on the grade 9 curriculum resulted from the fact that it was viewed as the one which prepared the student for high school.

While all these programs were being prepared for the students, many parents and other interested people in the community did not fully understand what was happening in the schools regarding these mathematics programs. Therefore an informational guide, titled *Course Descriptions Intermediate and Secondary Schools Grades 6-12*, was prepared by the Bureau of Curriculum Development of the New York City Board of Education in 1970 to present an overall view of the school mathematics programs. It was designed for school personnel, parents, and interested members of the community. This bulletin was prepared in response to what mathematics education officials saw as the growing interest in the curriculum, its courses of study, and the learning that was taking place day by day in the classrooms of the public schools.⁴⁸

The mathematics programs outlined in these course descriptions were revised to include some topics on “new math” which were not present in the earlier traditional course. For example, the grades 6, 7, and 8 topics now included more emphasis on Sets, Venn diagrams, probability and statistics, and algebraic concepts. The grade 8 topics also included addition and multiplication in base 2 and base 5.⁴⁹ The study of number bases other than base ten was emphasized, since it was considered necessary for the understanding of the number system. On the other hand, Sets and Venn diagrams were considered to be major “new math” topics and if they were not included in the syllabus then no “new math” was being taught.

48. Lester, “Foreword in Curriculum Bulletin 1969-70, 1969-70 Series, No. 11,” 1970.

49 New York City Board of Education, “Curriculum Bulletin 1969-70, 1969-70 Series, No. 11,” 1970.

The New York City Board of Education did not prepare material only for consumption by parents; it also prepared lesson plans as models for use by teachers. These lesson plans were based on the mathematics program which was developed by the Curriculum Development Division. An example of a Grade 8 lesson plan which was prepared by the New York City Board of Education is shown below (Figures 3-10a and 3-10b). According to the bulletin, *Mathematics, 8th Year, Part 1*, the program was presented in a series of daily lesson plans for use by the teachers. These lesson plans were the culmination of two years of experimentation in various schools in each of the five boroughs of New York City. They reflected the experiences gained in actual classroom situations and the continued evaluation by teachers and supervisors.⁵⁰

These materials were arranged in the sequence in which they were to be used by the teacher. The teachers were advised that practice in computation and in the solution of verbal problems should not be confined to the sections in which the work appeared. The intention was that such work should be interspersed among other topics in order to sustain interest and provide for continuous development and reinforcement of computational skills and of problem solving. All this was followed by an evaluation program which included the checking of completed work and continual appraisal. The objectives against which the results of the evaluations were checked were “the development of concepts, principles, and understanding, as well as skills”.⁵¹

Figure 3-10a
Grade 8

50. New York City Board of Education, Introduction to *Mathematics 8th Year, Part 1*, New York City Board of Education, 1969.

51. New York City Board of Education, Introduction to *Mathematics 8th Year, Part 1*, New York City Board of Education, 1969.

Lesson 10

Topic: Angle Measurement

Aim: To review the use of the protractor

Specific Objectives:

To reinforce the ability to read the protractor
To measure angles using the protractor

Challenge: Which angle has the greater measure?
How much greater?



Note to Teacher: It is suggested that rexographed sheets be prepared with drawings of the two angles in the challenge and the angles in B-3 and B-4. In the challenge, $\angle A = 50^\circ$ and $\angle B = 40^\circ$. Use of an overhead projector is recommended.

I. Procedure

A. The protractor

1. Have pupils recall that there is an instrument for measuring angles called a protractor.
2. Have pupils study their protractors. Discuss the instrument.
 - a. The protractor is divided into 180 unit angles. The standard unit of angle measure is one degree, 1° .
 - b. The common end point of the rays is indicated on the protractor. It is generally pointed to by an arrow. Only part of each ray is shown.
 - c. The numerals name every tenth ray. From one numeral to the next there are ten divisions.
 - d. The measure of the angle indicated by any two successive markings is 1° .

Source: New York City Board of Education,
Mathematics 8th Year, Part 1, 1969.

Figure 3-10b
Grade 8

- e. There are two scales on the protractor, one reading from left to right clockwise, and one reading from right to left counterclockwise.

B. Measuring angles with the protractor

1. Measuring $\angle A$ and $\angle B$ of the challenge

a. Measuring $\angle A$

- 1) What kind of angle is $\angle A$? (acute) Why?
- 2) Have pupil place the arrow on the protractor at the vertex of $\angle A$.
- 3) Place the protractor so that the ray marked 0 lies along one ray of the angle.
- 4) Place pencil point at the point on the protractor where the other ray forming the angle crosses the protractor. (Extend ray, if necessary.)
 - a) What numerals mark the point? (50, 130)
 - b) Recall that $\angle A$ is acute. What numeral on the scale will you select as the measure of the angle? (50) Why?
- 5) Angle A measures 50° or $\angle A = 50^\circ$.

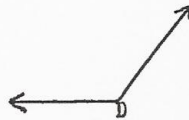
b. Measuring $\angle B$

- 1) Follow procedure used in measuring $\angle A$.
- 2) Angle B measures 40° or $\angle B = 40^\circ$.

c. How much greater is $\angle A$ than $\angle B$?

3. Measuring an angle such as $\angle D$

- a. What kind of angle is $\angle D$? Why?



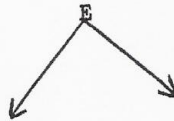
- b. Have pupils place arrow of protractor on vertex of angle. Place the edge representing the zero ray on the left along one ray of the angle and note at what point the other ray crosses the protractor.

- c. Recall that $\angle D$ is obtuse. What numeral on the scale will you select as the measure of the angle?

- d. $\angle D = 135^\circ$.

4. Measuring an angle such as $\angle E$

- a. What kind of angle is $\angle E$? (Pupils will probably estimate near 90° .)



Source: New York City Board of Education,
Mathematics 8th Year, Part 1, 1969.

The prepared lessons in Figures 3-10a and 3-10b gave very specific instructions to the teacher, so the teacher was allowed very little discretion in presenting them. For example, the

“Note to Teacher” suggested what materials should be used and how the lesson should be presented. Further, the teacher was given detailed instructions regarding the procedure to be followed and the discussion to be held with the class. This is the method that was followed throughout the entire lesson unit. It appears to be a direct result of the procedure outlined by the developers of the “new math” curriculum in which the teacher’s delivery to the class was very much scripted. The “new math” was concerned with pedagogy as well as content.

Previously, in the traditional junior high school mathematics curriculum, there was no logical development of the mathematical ideas to help students understand numbers or the meaning of operations. The main emphasis was on whole-number arithmetic, fractions, decimals, and percents.⁵² The influence of the “new math” brought about a slight shift in this approach. The work of the Junior High School Curriculum Division was thus nudged ever so gently in the direction of mathematical modernity; and although there was still some emphasis on the above mentioned topics, a conceptual approach was attempted, as can be seen from the illustrated examples.

In the early 1970s some aspects of the “new math” was introduced into the 7th grade curriculum. The curriculum that was prepared in 1958-59 dealt with the following topics: (a) The Meaning of Numbers; (b) Fundamental Operations with Integers; (c) Fundamental Operations with Common Fractions; (d) Fundamental Operations with Decimals; (e) Percentage; (f) Graphs; (g) Measurement; (h) Geometric Forms; (i) The Circle; (j) The Angle; (k) The Triangle, and (l) Applications of Mathematics to Life Activities. When this was revised in the mid-1960s, however, some “new math” concepts were introduced into the curriculum. Most prominent

52. Payne, *The New Math* 560.

among these was the idea of Sets. To many of those who had adopted the “new math” the idea of Sets was perhaps the most important concept introduced by the developers of the “new math.”

In the case of the 6th grade curriculum, there was, as evidenced by the grade 6 lesson plan shown in Appendix F, a heavy emphasis on whole number operations. This lesson dealt with long division, and at the end of the lesson it was expected that students would be able to divide a 4 digit or a 5 digit dividend by a 2 digit divisor and also be able to check the answer by correctly finding the product of the quotient and the divisor. The focus on whole number operations was a major aspect of the traditional curriculum. This lesson was an example of that practice and thus showed no evidence of the “new math” influence.

The 6th grade curriculum did have some input from the “new math”, however, as was indicated by the document setting out the Scope of the curriculum and the cycles to be followed.⁵³ The 6th grade mathematics was divided into four major topics, Numbers: Addition and Subtraction, Multiplication and Division, Fractions, and Measurement and Geometry. The idea of a set was developed and explored in cycle 1 of the Section on Numbers. Various aspects of Sets were discussed, including set notation, elements of a set, subsets, and union of sets. This continued in two of the other three cycles, in which they dealt with the intersection of Sets. The introduction of Sets into the 6th grade curriculum was a distinct shift away from the traditional 6th grade curriculum of the 1950s.

Shortage of Mathematics Teachers

During this period the New York City education system faced several challenges, including the teachers strike and the corruption scandal, but one of the most serious was the

53. New York City Board of Education, *Mathematics Cycles Grade 6*, September 1965.

persistent shortage of mathematics teachers in the junior high schools.⁵⁴ Overall there was a general shortage of mathematics and science teachers, but in the junior high schools the situation was acute. However, this shortage of mathematics teachers in particular, and teachers in general, was not unique to New York City, as it affected all other major cities in the nation.

The shortage of teachers in the junior high schools was identified in the fall of 1954 when it was found necessary to recruit 1960 teachers from outside the division to teach there. Notwithstanding all the concern about the teacher shortage, a decade later, in January 1966, Dr. Theodore Lang, Deputy Superintendent of Schools, predicted that in September that year the junior high schools would need to fill 346 positions mandated by UFT contract, and 964 others for a total of 1310.⁵⁵ He anticipated that there would be 980 appointments and that would leave 330 positions unfilled.⁵⁶ Unfortunately, there were no data to indicate how many of the 1310 teachers taught mathematics.

It has been said that one of the pivotal causes of inadequate school performance was the inability of schools to adequately staff classrooms with qualified teachers.⁵⁷ New York City has always been subject to the problem of teacher shortage in general and mathematics teachers in particular. Further, the junior high schools were particularly prone to this problem. This situation was again highlighted in October 1955 in a memo to the Youth Education Committee, (a sub-unit of the Public Education Committee) by its president, Mrs. Charles Schlaifer, who claimed,

54. Levin's definition of "shortage" will be used here. He defines it as the situation in which an inadequate number of teachers with appropriate qualifications offer their services to the schools at prevailing salaries and working conditions relative to the openings in the schools for such teachers.

55. The 964 other vacancies were expected to come from cessation of service for various reasons by regularly appointed teachers.

56. Minutes of the Meeting of the Ad Hoc Committee of Recruitment, Training, and Promotion of Teachers and Supervisors, New York City Board of Education, January 17, 1966.

57. Ingersoll, *Is There Really a Teacher Shortage?*, September, 2003.

“The shortage of fully qualified teachers for the junior high schools is worst this year than last.”⁵⁸

According to Levin the primary cause of the persistent shortage of mathematics teachers was that college graduates with degrees in mathematics had more lucrative opportunities available to them than those in other disciplines. Although Levin was referring to the country as a whole, an urban city like New York was particularly susceptible to this problem. One suggestion that was offered to offset this imbalance was that qualified mathematics teachers should be offered a higher salary in order to make teaching more financially attractive to them. Levin claims that in 1973-74 the estimated annual salary advantage for a Bachelors degree candidate in mathematics who chose a position in business and industry instead of teaching mathematics was \$5417.⁵⁹

The Board of Examiners was identified by many people in the education community in New York City as the major cause of the teacher shortage.⁶⁰ Its lengthy testing procedures in the 1950s put the city at a serious disadvantage in the competition with suburban districts, which were hiring teachers on the spot.⁶¹ Then in the 1960s it came under heavy criticism from civil rights groups who felt that the written and oral tests discriminated against minorities. It was also reported that in 1966 there was a ten-month span between the date of taking the examination for

58. Schlaifer, Letter to the Members of the Youth Education Committee, October 6, 1955, New York City Municipal Archives, Series 672, Box 5, Folder 1.

59. Levin, *Solving the Shortage of Mathematics and Science Teachers*, 375

60. The Board of Examiners was created when the New York City school system was centralized in 1898. It was a semi-autonomous arm of the Board of Education formed for the purpose of administering tests to prospective public school teachers. The stated purpose of the board of examiners then was to hire and promote teachers based on the results of objective tests. While some educators felt that the testing function of the Board of Examiners was unnecessary, others felt that it had become more necessary than ever if the high quality of teachers was to be maintained. *Teachers College Record* Volume 108 Number 4, 2006, 726-747 <http://www.tcrecord.org>.

61. Diane Ravitch, “How to get the good teachers we need,” *Daily News*, Tuesday, January 31, 1978.

license as a regular teacher and the tentative date of appointment, although it only took about three months to mark the examinations and prepare the lists.⁶²

Because of what was considered the shortcomings of the Board of Examiners there was a call by its critics to abolish it. However, its defenders saw it as the last bulwark of the merit system.⁶³ The fear was that without the Board of Examiners teachers would be hired by political patronage, color of skin, or religion. This is exactly what it was set up to prevent in 1898.

So dire was the situation regarding teacher shortage in the schools that on January 19, 1966, Superintendent Donovan presented the following resolution to the Board of Education:

WHEREAS, There exists a shortage of teachers in many curriculum areas;
and

WHEREAS, There are persons qualified and available to meet the needs of the schools who cannot serve for a full day but who are available to serve part-time;
and

WHEREAS, In special curriculum areas the ability to hire on a part-time basis members of professions which are closely related to the school program can provide a strengthening of the quality of teaching available in these special areas;
and

WHEREAS, It is desirable for Heads of Schools to have the flexibility to assign qualified persons to part-time employment in the schools; therefore be it

62. New York City Board of Education, "Report of Ad Hoc Committee," January 31, 1966.

63. Ravitch, How to get the good teachers we need, *Daily News*, Tuesday, January 31, 1978.

RESOLVED, That the schools be authorized to employ qualified substitute teachers for less than a full day of teaching service on a per session basis, and that salaries, vacation allowances, accumulated absence reserves and any other benefits granted to per diem substitute teachers shall be granted to the part-time teachers on a pro rata basis.⁶⁴

This persistent shortage of qualified teachers forced the New York City Board of Education to develop new and novel strategies for attracting and recruiting new teachers. In 1966 one such strategy, Operations Reclaim, brought teachers from the South into New York City schools. In the case of Operations Reclaim, 50 African American teachers from the South who had lost their positions when their All-Black schools were closed as a result of desegregation, and who had been working in New York City in various menial occupations, were accepted to be trained as teachers in the City school system. Dr. Bernard E Donovan, the New York City Superintendent of Schools, told them then “We need you just as much as you need us.”⁶⁵

The program did bring some relief to New York City schools, but not much in the critical shortage area of junior high school mathematics. Of the fifty teachers who entered the system through the program, about twenty-five were interested in early childhood education, two were trained in special education, and the rest specialized in high school subjects. None of these teachers was trained to teach junior high school mathematics. Thus, the situation in the junior high schools remained essentially the same, with many of those who were teaching mathematics

64. Bernard Donovan, Letter to the New York City Board of Education, January 19, 1966.

65. Leonard Buder, City is Training Ousted Teachers, *New York Times*, January 1, 1966.

still teaching out-of-license. The fact that not one of the fifty teachers taught mathematics was indicative of the difficulty in finding mathematics teachers.⁶⁶

.Operations Reclaim was started in the previous summer by the New York City school system for the specific purpose of attracting those displaced teachers from the South. This training program, known formally as the National Defense Education Act Institute, was made possible by a grant of \$135,000 from the United States Office of Education. Each participant in the program received \$75 a week plus \$15 a week for each dependent.⁶⁷ They were to undergo an 18-week training program in classes that met the special needs of each individual. The classes included reading techniques, language arts, guidance, and curriculum and school organization.

As part of the program's outreach, Dr. Max S Meiselman, the Director of Operation Reclaim, along with other officials was sent to Dallas, Tuskegee, Alabama; and Raleigh, N.C., to actively recruit suitable candidates for teaching positions in New York City. In some instances the recruiters were not very welcome in the South. Local school officials there secretly opposed the recruitment of the African American teachers, whom they had discharged claiming that they were unqualified for southern schools and who had turned out to be quite suitable for the schools in New York City.

A recommendation of the 1962 evaluation of the New York City School system, conducted under the auspices of the State Education Department, was proposed by Harold Siegel, Executive Assistant to the Committee on Teacher Recruitment, in October 1965 to deal

⁶⁶ All the Southern teachers had baccalaureate degrees, and some even had graduate degrees. All were trained and experienced teachers who had previously taught at all-Negro schools in the South but had lost their jobs when their schools were desegregated. Nineteen of those selected for the training program were men and 31 were women. They ranged in age from 24 to 58.

⁶⁷ Leonard Buder, City is Training Ousted Teachers, *New York Times*, January 1, 1966.

with the prevalence of out-of-license teaching in the junior high schools of the city.⁶⁸ It was recommended that “an emergency recruitment program be embarked upon” immediately to provide a reservoir of newly licensed teachers to alleviate the prevalence of out-of-license teaching which existed at the time.⁶⁹ He further suggested that the time consuming methods of the Board of Examiners should be replaced with more expeditious methods of teacher selection.

All the initiatives and recommendations mentioned above aimed at ending the shortage of teachers in the New York City schools met only moderate success. The fact is that these appeared to be only piecemeal, while what was needed was a more thorough and revolutionary approach. First, the recruiting and hiring policies had to be revised. Secondly, the salary structure for teachers had to be upgraded. The Board of Education, however, was not ready for any such policy shift, and neither was it financially able to offer its prospective teachers a remuneration that could have been considered competitive. As a result the teacher shortage continued to plague the city schools.

The Teachers’ Strike—1968

Much discussion has taken place over the years on the teachers’ strike of 1968; therefore, it is not the intention here to simply add to that discussion, but to examine what effects the strike had on the mathematics students in the junior high schools. All the efforts to raise the mathematics scores of those students had to be suspended in the latter part of 1968 because of the turmoil in the education system brought about by warring factions over decentralization and community control. Because of this, classes had to be suspended on quite a few occasions. From

68. Harold Siegel, Memo to Dr. Clarence Senior on Instructional Progress in the Public School of New York City, October 29, 1965.

69. Siegel, Memo to Dr. Clarence Senior.

May to December, 1968, the skills of Schools Superintendent, Dr. Bernard Donovan, were put to the test in dealing with the “fight over teacher’s rights and the struggle of a predominantly Black community to gain control over an experimental decentralized school district known as Ocean Hill-Brownsville.”⁷⁰

The teachers were strongly opposed to decentralization and community control because they feared that their bargaining power would be terribly weakened if they had to negotiate with several different community boards. Meanwhile community leaders believed that the administrative structure of the central education authority was not meeting the needs of their communities and demanded nothing less than full control of the schools in their various districts. As is already well known, the New York City Board of Education responded to the demands of the community leaders by setting up three experimental school districts carved out from already existing districts. The three districts all served communities with leaders who were extremely militant in their demands, but it was the actions of the leaders in the Ocean Hill-Brownsville district that became the lightning rod which set the city ablaze in a community--union strife.

The most significant developments in the Ocean Hill-Brownsville decentralization squabble involved the confrontation that erupted between community groups and the teachers union.⁷¹ The community control controversy produced many unpleasant effects, but the greatest tragedy was that it escalated the Jewish-Black tension, primarily because Jewish educators

70. McFadden, Bernard Donovan, Ex-New York Schools Superintendent, Dies,” *New York Times*, October 28, 1978.

71. Michael D Usdan, “An Analysis of New York City Participation Experiments,” *Theory and Practice*, 8, no. 4, Oct 1969, 268.

predominated in the school system at the time.⁷² This became a bitter confrontation, characterized by racist and anti-Semitic charges between the adversaries, charges which “threatened to destroy New York City’s very political and social fabric.”⁷³ A militant union, which had just recently grasped power and was trying to hold on to that power, faced militant community groups and their leaders, who believed that their children were not being given the very best education and were determined to take control of their children’s education.

It is a well known fact that mathematics students need to have continuous re-enforcement of their lessons. Without this, students tend to fall behind and seem to lose what they had learned. The New York City junior high school students who were already weak in mathematics could ill afford to be away from their mathematics classes for any length of time. While it is not known if any study was done on the effects of the teachers’ strike on the mathematics students, it is easy to understand that these unfortunate children were set back a great deal as a result of the strike. Research by Sousa appears to support this argument.⁷⁴ He found that continued practice helps to make what is learned permanent and if the practice is suddenly stopped then the skills mastery tend to decline.

This prolonged turmoil in the education system denied the New York City children the benefit of a proper mathematics education. Many in the community saw the disruption of the children’s education as the most important effect of the struggle. This was a point emphasized by

72. David Rogers, *110 Livingstone Street Politics and Bureaucracy in the New York City School System*, New York, Random House, 1968.4.

73. Usdan, *An Analysis of New York City Participation Experiments*, 256.

74. David A. Sousa, *How the Brain Learns*, (Thousand Oaks: Corwin Press, 2006), 97.

Dr. Donovan who claimed that all he wanted to do was to keep the schools open.⁷⁵ The disruption further aggravated the already weak performance in mathematics by the students. In particular, the junior high schools students, who already hard hit by the shortage of qualified mathematics teachers, now had to face another disruption in their education.

The end of the strike left the schools with a lot of lost time to make up. The Board of Education initially announced that the school day would be extended by 45 minutes daily for 14 weeks. In addition, there would be ten days of extra classes carved out of vacation periods. Teachers and students protested, however, and it was decided that the ten days would be optional.⁷⁶ It is not known how the extra time was utilized but it would have been extremely beneficial for the struggling mathematics students.

While there are no similar scores available for mathematics, the reading scores for all eight schools in Ocean Hill-Brownsville on a standardized test in 1971 was lower than their scores in 1967 when the decentralization experiment began.⁷⁷ This is a clear indication that all was not well in that district. Mathematics, for which there was already a problem in recruiting qualified teachers, could well have been much worse. Perhaps community leaders in Ocean Hill-Brownsville, while intending to work in the interest of the children of the district, may have hurt rather than helped them.

75. Robert D. McFadden, "Bernard Donovan, Ex-New York Schools Superintendent, Dies," *New York Times*, October 28, 1978.

76. "Public Schools: Strike's Bitter End," *TIME*, Friday, November 29, 1968
<http://www.time.com/time/magazine/article/0,9171,841534,00.html>.

77. Ravitch, *The Great School Wars*, 391.

Summary

The period 1958-1975 appears to have been quite eventful with regards to junior high school mathematics education in New York City. It started with the efforts of the curriculum development committee to update the junior high school mathematics curriculum. This was no easy task, since the influence of the “new math” was making itself felt. What made the task extremely difficult was the fact that there were those in the mathematics education community who believed that the entire junior high school curriculum should consist only of “new math.” This was met by strong opposition from those who considered the “new math” too abstract and out of touch with reality. Hence, there was no consensus in the mathematics education community on the way forward.

The work of the curriculum development division of the New York City Board of Education continued even though the battle between the traditional curriculum and the “new math” was not resolved; and, as discussed in Chapter 4, continued to rage on. However, “new math” ideas and concepts did find their way into the junior high school curriculum, some of which were welcomed by some mathematics educators and disliked by others. The developers of the new curriculum perhaps considered that there were some aspects of the “new math” that were quite worthy of inclusion.

The major focus of the mathematics curriculum developers for the junior high schools in New York City at that time was the 9th grade. This was because this grade was considered to be extremely important because it prepared the students for high school. The mathematics classes in this grade were divided into two: Mathematics 9th Year and General Mathematics 9th Year. It was, of course, a form of tracking, since the less able students were placed in the General Mathematics 9th Year classes where the work was less challenging. Those students who were

considered more able were assigned to the Mathematics 9th Year classes where the work was more challenging. These were the students being prepared for college.

The period also witnessed a great need for mathematics teachers in the junior high school since many graduates with mathematics degrees preferred to seek employment in business and industry rather than education. This shortage of mathematics teachers was a problem that had been plaguing the city school system for many years. While the shortage of mathematics teachers was most acute, there was in fact, a shortage of teachers in general. As a result the New York City Board of Education was forced to develop novel ways to attract applicants. One such method was called “Operation Reclaim” which brought retrenched teachers from the South to teach in New York City.

In the latter part of 1968 the city school system was torn apart by a bitter struggle between the UFT and militant communities. The Board found itself as a hapless, and perhaps impotent, arbitrator in the unfortunate debacle. Those who suffered most were the poor and needy children, and in particular the middle school mathematics students, who could not afford to lose a day at school. Usdan suggests that the unpleasant situation could have been averted if there had been a clearer demarcation of responsibility between the Board of Education and the governing board in the district.⁷⁸ This is somewhat doubtful, however, since the community leaders were determined to have total control of the schools and the teachers were opposed to such control.

78. Usdan, “An Analysis of New York City Participation Experiments,” 270

CHAPTER FOUR

MIDDLE SCHOOL MATH IN NEW YORK CITY 1972-1988

Introduction

In the previous chapter I examined the “new math” and the influence that it had on the preparation of courses by the New York City mathematics curriculum division. I gave much attention to the separation of the 9th Year mathematics curriculum into the Mathematics 9th Year and the General Mathematics 9th Year. I also discussed the Board of Education’s reaction to the students’ weakness in mathematics. I also spent much time on the important issue of how influential the “new math” was on the work of the New York City mathematics curriculum developers. Another relevant question I discussed was the mitigating circumstances which restricted the “new math” from becoming the major curriculum at that time. In Chapter 4 I attempt to examine thoroughly and answer questions on the backlash against the “new math;” the new mathematics standardized test; the continuing decline of the mathematics scores; and the shortage of mathematics teachers.

I begin with a discussion of the literature that opposed the “new math” and the support for the “back to basics” movement. I examine the belief held by some scholars that, since not many schools fully adopted the “new math,” “back to basics” simply meant that the traditional programs were continued.¹ They could have well been referring to New York City since, as was discussed in Chapter 3 the middle school mathematics curriculum here was not very much affected by the new math. The fact is that for the vast majority of students in the New York City

1. Fey and Graeber, “From the New Math,” 538; Walmsley, *A History of the New Math Movement*, 88; Davis, “Changing School Mathematics,” 625

school system the mathematics curriculum consisted primarily of the traditional arithmetic with the routine drill and practice. There was no need, therefore, to go “back to basics” because the curriculum had changed very little.

I also look at the inability of the students to master the mathematics presented to them, as indicated by the results of the various state mathematics tests in the decade of the 1970s, and the attention given to the students’ weakness in mathematics. I discuss these in the context of the financial woe which caused the Board of Education to lay off teachers and cut back on essential educational services. The budget cuts forced the Board to close programs that were badly needed to assist students who were struggling with mathematics. As a result, the New York education system was therefore called upon to do much more with much less. As usual the underprivileged children were the ones who suffered most in all of this.

I look closely at the selection of the various chancellors and the politics that was involved in the process in order to understand and explain how these affected educational policy in New York City during this period. The power of a popular mayor and his ability to have his way is demonstrated in the case of Mayor Ed Koch, who was adamant in having Robert Wagner as head of the city’s education system. So determined was Mayor Koch, that even after being blocked from having Mr. Wagner appointed as chancellor, he was able to have him elected as president of the Board of Education three years later.

Most importantly, I examine in detail the citywide mathematics test scores of grades 2 through 9 students. I pay particular attention to the test scores of the students in grades 6 through 9 in view of the fact that a decline in these scores, as the students moved through the middle grades, was observed to be a regular feature. I compare and analyze the 1981 through 1987 test results so that a better perspective of the performance of the students during this period could be

obtained. An analysis of these scores will highlight the consistent problem in the middle grades which has been alluded to previously.

The Backlash against the “New Math”

In this period, 1972 through 1988, there was a backlash against the “new math” throughout the country. This was commonly called the “back to basics” movement, and it followed from the widespread displeasure with the content of the “new math” curriculum and from the fact that many students appeared not to be able to cope with simple everyday arithmetic. As a result there was a campaign mounted against the “new math” and a renewed emphasis on paper and pencil skills.²

In addition, the closing of the most successful academic group sponsoring the “new math,” the School Mathematics Study Group, (SMSG) in April 1972,³ and the untimely death of Professor Max Beberman, head of the University of Illinois Committee on School Mathematics (UICSM), helped to further the aims of the “back to basics” movement. These last two events greatly diminished the efforts of those who favored the “new math.”

Some scholars believe that the primary stimulus for the “back to basics” movement was “an emerging public consensus that post-*Sputnik* educational reforms were a failure.”⁴ Although Fey and Graeber believed that was the national consensus, they however found it necessary to modify the statement by saying that even though the belief was not unequivocally justified by professional evaluations of “new math” programs, there were some crucial indicators of school quality which supported the public perception. The 1977 report from the College Board, which

2. Walmsley, *The History of New Mathematics*, 89.

3. Payne, “The New Math,” 591; Walmsley, *The History of New Mathematics*, 89.

4. Fey and Graeber, “From the New Math,” 539

charted a 10-year decline in scores on the Scholastic Aptitude Test (SAT), was identified as one such crucial indicator.⁵

In addition to all this, the “social and political conservatives,” who decried the apparent loss of traditional values, are sometimes blamed, justly or unjustly, for helping to further the reaction against the “new math” and adding support to the “back to basics movement.”⁶ The contention is that the reaction of the conservatives, combined with the skepticism about the “new math” of some people in the mathematics community, resulted in a reduction of financial support for the reform effort. Thus the call for “back to basics” coincided with the reduction in funding from the National Science Foundation (NSF), which was the government agency who had funded many of the “new math” projects.⁷

The traditional mathematics curriculum received further support when it was found by the schools to be most suitable for use with the traditional standardized test to demonstrate the content their students had learned in a given period.⁸ This was in response to a call by President Nixon for accountability within the national school system, and the nation responded by seeking to demonstrate that accountability by showing the progress of the students in the schools.⁹ All this helped to move the mathematics curriculum away from the “new math” and greatly assisted those who supported the “back to basics” movement.

5. Fey and Graeber, *From the New Math*, 539

6. Fey and Graeber, *From the New Math*, 539

7. Fey and Graeber, *From the New Math*, 540

8. Walmsley, *The History of New Mathematics*, 90.

9. Walmsley, *The History of New Mathematics*, 90.

As was indicated earlier, many educators, parents, and mathematicians in the country felt from the early stages of the “new math” that it was, at best, a dismal mistake.¹⁰ They were worried that students were not equipped to perform the very basic computations that were necessary in daily life. The decline in students’ mathematics scores helped to further worsen their fears. Those early critics were later joined by others who expressed dissatisfaction, particularly with the performance of average and below-average students. They were also very concerned with the difficulty which the “new math” posed to disadvantaged students.¹¹ This was not relevant to New York City, however, since the “new math” had only a small impact on the curriculum and the General Mathematics program was reserved for those students who were not very comfortable with mathematics.

Even though the movement against the “new math” had started to gain momentum in the early 1970s, there were still some in the mathematics education community who were trying to ensure that it did not fail. In particular, some textbook producers who had expended much time, effort, and money on material for the “new math,” were not about to allow their investment to be lost. This is confirmed by an advertisement that was placed in the *Mathematics Teacher* of October, 1972. The advertisement offered a modern mathematics program for Junior High schools, specially designed for “mathematically gifted and motivated students,” along with a seven week training workshop for all new teachers of the program.¹² There is no evidence, however, to indicate what measure of success was achieved by such advertisements.

10. Frank Kendig, “Does new math add up?” *New York Times*, January 6, 1974.

11. Fred M. Hechinger, “Math: Integrating the New and the Old,” *New York Times*, May 4, 1974.

12. Some “new math” curriculum developers called their program “modern mathematics;” National Council of Teachers of Mathematics, *The Mathematics Teacher*, October 1972, 521.

There is, however, an important point that stands out in the advertisement. It seemed to indicate that the “new math” or modern mathematics, as it was sometimes called, was designed especially for the gifted and talented students. Those students were the ones who were expected to enter college and would have needed a solid foundation in mathematics. Hence they were given what was considered the more challenging material. The students who were not considered gifted were assigned less challenging material, since they were not expected to enter college and only needed sufficient mathematics for the workplace.

In New York City, the mathematics curriculum did not appear to be greatly affected by the “back to basics” movement since, as discussed in Chapter 3, the traditional curriculum had remained intact throughout the “new math” controversy. This was particularly true of the General Mathematics 9th year curriculum. The major input of the “new math” to the New York City middle school mathematics curriculum was the introduction of set theory, the various mathematical properties, and the use of what was considered precise mathematical language. A good example is that the distinction between a *numeral* and a *number* was considered to be extremely important. Apart from that, the middle school mathematics curriculum remained essentially the same for most students in the city throughout the 1970s.

Scholars fail to agree on the level of success (or deficiency) of the “new math.” Some claim that it was much sought after as, “almost every school and school system clamored to find out about the new math because they could not be viewed as being behind the times.”¹³ Others saw it as a total failure and suggested that, “Given the data indicating the modest influence of “new math” proposals, some may wonder whether “back to basics” might not have more aptly

13. Payne, “The New Math,” 575.

been called “on with basics.””¹⁴ Yet another writer believed that in schools where the “new math” programs were tried some probably failed, but “some were successful in the extreme.”¹⁵

What appears to be a more realistic interpretation of the facts regarding the state of the “new math,” however, is the one given by Herbert J. Greenberg; in an article in the *Mathematics Teacher*, November 1974, he suggested that there was in fact no wholesale abandonment of the “new math.” He said that in the late 1960s, the pendulum started to swing again—not back to the old mathematics, but away from the extremes of the new mathematics and toward a kind of middle ground that acknowledged the need for computational skills as well as the applications of mathematics.¹⁶ He seemed to suggest that the “new math” was not dead but that there was a movement toward a milder form while incorporating some of the traditional mathematics.

Budget Cuts Hinder Improvement Efforts

The performance of the middle school students in New York City was not satisfactory in mathematics, and the education authorities at both the state and city levels were very much disturbed by the apparent inability of the students to perform at the standard required of them. However, notwithstanding the many efforts of the various education authorities, the mathematics scores of the middle school students remained quite unsatisfactory.

The fears of the education authorities were relieved when the overall New York City students’ scores on the state mathematics test placed just 35 percent below the reference point in 1972.¹⁷ They were given further hope for the future when it was revealed that of the students

14. Fey and Graeber, *From the New Math*, 539

15. Davis, “Changing School Mathematics,” 626.

16. National Council of Teachers of Mathematics, *The Mathematics Teacher*, November 1974, 639.

17. Leonard Buder, “Reading Scores for City Pupils Are Improving,” *New York Times*, September 20, 1973.

tested in 1966, 54 percent scored below reference point and this fell to 39 percent in 1970, stayed at 39 percent in 1971, and fell to 35 percent in 1972.¹⁸ While the decline in those falling below the reference point reduced a source of worry for Chancellor Harvey Scribner, he had much more than the performance of his students on his mind in 1972. His biggest concern was finding the money to operate the city public school system. To meet that obligation he needed \$2 billion for the new fiscal year that was to begin on July 1 that year.¹⁹ Funding was difficult to obtain at the time because of the early tremors of a looming financial crisis, tremors which caused Murry Bergtraum, the chairman of the Board of Education finance committee, to remark that “the city faced a bleak future.”²⁰ However, the full shock was not felt until a few years later when the New York City education system was left reeling by severe budget cuts.²¹

Notwithstanding the budget woes, the efforts to improve the overall ability of the students, particularly the mathematics scores, continued with some success. The results of two tests gave the board some hope. The first was the results of the reading test which showed that the citywide averages for 1973 were better than those of 1972. The second was the report by Victor Taber, Director of the State Education Department testing division; this report indicated that there was an improvement in the city’s third and sixth grade mathematics capabilities.²² The challenge now was the task of developing a program of mathematics instruction throughout the city which would lead to further improvement in the scores of the students. Figure 4-1 below²³

18. Leonard Buder, “Reading Scores for City Pupils Are Improving,” *New York Times*, September 20, 1973.

19. Leonard Buder, “Cutbacks in City,” *New York Times*, June 10, 1972.

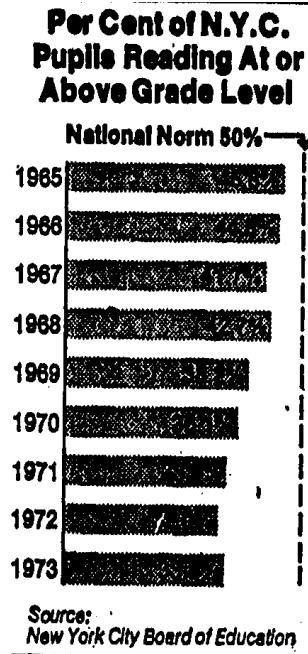
20. Leonard Buder, “Cutbacks in City,” *New York Times*, June 10, 1972.

21. Leonard Buder, “Schools Open Today in New York City,” *New York Times*, September 13, 1976.

22. Leonard Buder, “Reading Scores for City Pupils Are Improving,” *New York Times*, September 20, 1973.

23. Leonard Buder, “Pupils Here Show a Gain in Reading,” *New York Times*, February 15, 1974.

Figure 4-1



clearly shows how the New York City students performed on the state reading test from 1966 through 1973. It indicates that the reading scores fell from 45.8 percent in 1966 to 32 percent in 1972 and improved in 1973 to 33,8 percent. Unfortunately data on mathematics for the period were not available; but the data on reading scores may be used as a guide, since the report indicated that in 1973 there was also a turnaround in some mathematics scores and this is quite similar to what occurred in reading.

Further setbacks were experienced by the education system when, as a result of economy measures in the 1975-76 school year, the Board of Education was forced to retrench 21,000 employees (more than half of whom were teachers); shorten the school week for students by 90 minutes; increase class size by four or five students; and eliminate or curtail important school

services and programs.²⁴ These cutbacks dealt a severe blow to the city's already struggling students. Because of the cutbacks there was a severe reduction in professional development for mathematics teachers and in the supply of resources and services to their students. Table 4-1 below shows the change in the total education budget in the fiscal years 1974-75 and 1975-76.

Table 4-1

Total Board of Education Budget (Includes funds from all sources)			
	1974-75	1975-76	Change
Funds controlled by the Board of Education	1,424,497,195	1,221,529,509	—202,967,686 —14.25%
From City tax levy	464,522,588	324,645,208	—139,877,386 —30.1%
Funds over which the Board of Education has little or no control	1,441,283,632	1,570,615,603	+128,831,971 +8.94%
From City tax levy	902,443,667	1,084,850,298	+182,436,631 +20.2%
Total Budget	2,866,280,827	2,792,145,112	—74,135,715 —2.59%
From City tax levy	1,366,966,255	1,409,525,506	+42,559,251 +3.1%

Source: The New York Times, June 21, 1976^F

From the table it could be seen that the funds controlled by the Board of Education was reduced by \$202.9 million, or by 14.25%. According to the Board the total budget of \$2.8 billion was in fact \$270 million short of what was needed to maintain programs and services at the previous year's level.²⁵

24. Leonard Buder, "New York City Schools Weather Fiscal Crisis," *New York Times*, June 21, 1976.

25. Leonard Buder, "New York City Schools Weather Fiscal Crisis," *New York Times*, June 21, 1976; Details were not available as to the amount of money that was cut from the various programs and services.

New Standardized Mathematics Test Introduced

In its continuing endeavors to improve the standard of middle school mathematics education in the City, the Board of Education focused on the use of testing. This was based on the Board's affirmation that, "Annual testing in mathematics is based on the belief that regular assessment of student achievement provides essential information which allows educators to address the instructional needs of students, to measure the effectiveness of educational programs, and to make decisions regarding future educational plans."²⁶ To this end a new nationally standardized norm-referenced test in mathematics, the Stanford Diagnostic Mathematics Test, was administered to all grades 2 through 9 students in 1981. Table 4-2 (p106) shows the Citywide Percentages of students in grades 2 through 9 who were at or above grade level in mathematics for the years 1981 through 1985.

26. Division of Curriculum and Instruction, "A Summary of the April 1983 Citywide Mathematics Test Results," Grades 2 through 9 Pupil Mathematics Achievement, New York City Board of Education, 1983, New York City Municipal Archives, Series 1120, Box 10, Folder 103.

Table 4-2

Citywide Percentages of Students
At or Above Grade Level in Mathematics*
1981 - 1985

<u>Grade</u>	<u>Year</u>				
	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
2	53.4	56.2	59.4	60.2	63.2
3	62.5	68.6	72.5	73.0	74.6
4	54.4	61.9	62.3	64.1	64.5
5	55.5	62.6	62.2	63.5	63.7
6	52.6	59.5	60.1	60.9	59.8
7	38.8	47.1	47.7	54.8	52.9
8	38.6	49.4	52.7	51.1	51.8
9	29.5	35.2	36.4	42.2	38.3
City- wide	49.6	56.6	58.1	59.9	60.2

*Limited English proficient students who were excused from testing are reflected in these numbers since such students are presumed to have scores below grade level.

Source: New York City Board of Education, 1985

An examination of table 4-2 shows that 55.5 percent of the grade 5 students in 1981 scored at or above grade level. However, when the scores in the middle grades are looked at, it will be observed that there is a noticeable decline as students move up through the middle grades. While 52.6 percent of the grade 6 students had scores above grade level, grade 7 students

were only 38.8 percent above grade level; grade 8 students were 38.6 percent; and only 29.5 percent of grade 9 students were at or above grade level. The decline in the number of students at or above grade level as they moved upward through the middle grades was therefore quite conspicuous.

However no explanation was offered by the chancellor for the decline in the scores. It is of interest to note that only 24,875 of the 9th grade students took the Metropolitan Achievement Test in 1985. This was less than half of those who took the 8th grade test; the reason for this was that more and more 9th grade students were now taking the New York State Regents examination in mathematics, an examination which was supposed to be much more demanding. Therefore, one theory which could be advanced for the decline in the 9th grade scores is that only the less able 9th grade students were now being offered the Metropolitan Achievement Test hence the reason for the decline.

The chancellor, Frank Macchiarola, claimed that what was being seen was a good sign up to the sixth grade, but not good after that.²⁷ His comments referred to the previously discussed persistent pattern of declining scores in the middle grades. It was also found that basic computational skills like adding, subtracting, multiplying, and dividing were enough to get students through arithmetic lessons in the elementary classroom, but that the students apparently did not have the necessary thinking skills to solve problems utilizing these basic skills. This point was further stressed by Charlotte Frank, the curriculum director for the New York City public

27. Gene L. Maeroff, "Math in City Schools, News Analysts," *New York Times*, May 30, 1981.

schools at that time, who commented that the ability to solve problems and think clearly transcended problems in mathematics.²⁸

A modified version of the Stanford mathematics test, which had been given the previous year, was given to 412,328 students (excluding LEP students) in 1982.²⁹ There was a slight overall increase in the number of students scoring at or above grade level in that year. In 1981, Citywide 49.6 percent of students were above grade level; in 1982 this increased to 56.6 percent, an increase of seven percentage points. Again, the number of grade 5 students at or above grade level was greater than those in the middle grades. The number of grade 5 students scoring at or above grade level in 1982 was 62.6 percent; after this, as was the case in 1981, there was a steady decline in the number of students scoring at or above grade level.

Table 4-2 indicates that in the year 1982, the number of grade 6 students who were at or above grade level was 59.5 percent; in grade 7, it was 47.1 percent; in grade 8, it was 49.4 percent; and in grade 9 it was 35.2 percent. Observe that between grade 7 and grade 8 there was an actual increase of 2.3 percentage points, but that there was a steep fall between grades 8 and 9 of 14.2 percent. The net decline in the number of students at or above grade level between grade 6 and grade 9 was 24.3 percentage points. The fact that there was such a steep fall in the scores was a stark reminder that there was something seriously wrong with the content and delivery of the middle grade mathematics curriculum.

The Stanford test was again administered in 1983, but this was a new customized version. It combined components of the original Stanford test with unique items developed for New York

28. Gene L. Maeroff, "Math in City Schools News Analysts," *New York Times*, May 30, 1981.

29. Division of Curriculum and Instruction, "A Summary of the April 1983 Citywide Mathematics Test Results," Grades 2 through 9 Pupil Mathematics Achievement, New York City Board of Education.

City that matched objectives in the New York City mathematics curriculum. An attempt was made to maintain the integrity of the national norms by selecting approximately 70-75 percent of the items from the original Stanford test. According to the *Summary of the 1983 Test Results*, this new customized version was a standardized norm-referenced and criterion referenced test. It was also grade appropriate, and, as was indicated above, specifically designed to closely match the New York City mathematics curriculum.³⁰

The results of the 1983 citywide mathematics test are also shown in Table 4-2, and they indicate that 58.1 percent of the students in that year scored at or above grade level. This was an improvement over both 1982, when 56.6 percent of the students scored at grade level, and 1981 when it was 49.6 percent. The trend from the previous two years continued in 1983. In this year 62.2 percent of grade 5 students scored at or above grade level. This was a decline of 0.45 percentage points from 1982. Again the number of students scoring at or above grade level fell in the middle grades. For example, the number of students at or above grade level in grade 6 was 60.1 percent; in grade 7 it was 47.7 percent; grade 8 was 52.7 percent, and grade 9 returned the smallest number of students at or above grade level which was 36.4 percent. These results were in keeping with the trend established over the previous years.

The testing policies continued and the Stanford Diagnostic Mathematics Test (in amended form) was used for this purpose in 1984. The mathematics test results for spring 1984 showed that the citywide test score had improved by just two percentage points over the previous

³⁰ New York City Board of Education, *A Summary of the April 1983 Citywide Mathematics Test Results Grades*, 1983.

year. The middle grades had also shown some small improvement. While this was a very small change, it was in the right direction, and it created some hope.

These results also indicated that New York City public school students continued a limited upward trend in their mathematics scores for the third straight year. A total of 421,972 students in grades 2 through 9 took the test. All districts, with the exception of three, showed improvement in their scores. The three districts that suffered a decline in their scores were District 12 in the Bronx, District 29 in Queens, and District 32 in Brooklyn.³¹ The districts which had the decline were in areas of low income, poor housing, and had a high concentration of recent immigrants. These districts tended over the years to pull down the citywide average.

Noguera and Quinn have suggested that the low scores and poor performance of students in schools located in areas such as those above result from the fact that such schools are populated by the most disadvantaged students and staffed by the least experienced teachers.³² This appears to be one problem that has plagued the New York City school system for a very long time. There has almost always been a shortage of qualified mathematics teachers, and those who were qualified tended to prefer schools in the more affluent communities. One occasion on which the supply of teachers exceeded the demand was in the early to mid-1970s when severe budget cuts forced the city to drastically reduce its education services. As a result in 1973 the only two teaching areas that were in demand were special education and physical education,³³

As soon as the economy recovered, however, the Board of Education was again faced with an acute shortage of teachers. The shortage was so acute that as early as January of 1978

31. Joyce Purnick, "Math Scores Rise In City Schools For 3D Year," *New York Times*, June 4, 1984.

32. Noguera and Quinn, "Task Force Report," 2007, 11.

33. Leonard Buder, "In a Surplus Market, Teachers Wait," *New York Times*, November 27, 1973.

about 2000 new teachers were needed by mid-February.³⁴ By 1985 the situation had worsened to the point where New York City urgently needed 250 mathematics teachers and 190 science teachers to fill vacancies in the schools. So bad was the situation that a survey found that 25% of teachers who taught mathematics and 33% of those who taught science were teaching out of license.³⁵

The fact is, though, that the New York City Board of Education made continuous efforts to relieve the shortage of trained mathematics teachers. Attesting to this fact was the report of a group of outside evaluators that demonstrated significant progress in the Board's program designed to ease the teacher shortage in mathematics and science. This program involved 521 public school teachers in tuition free undergraduate courses in mathematics or science at 11 colleges and universities in the city. This was the first part of the Board's Mathematics/Science Recertification Program and ran from fall semester 1983 through summer 1984.³⁶

The evaluation committee was quite distinguished; its members were Phillip Hallinger, Ph.D., St. John's University; Phillip Merrifield, Ph.D., New York University; John B. Poster, Ph.D., Fordham University, and Richard Wolf, Ph.D., Teachers College, Columbia University. Their report was well received by policy makers in the New York City education system as they were quite proud of the program. This pride showed in a statement made by Charlotte Frank, Executive Director for Curriculum and Development. She said, "The New York City school

34. Ari L. Goldman, "Job Call for 2000 Teachers Stirs Applicant Rush," *New York Times*, January 31, 1978.

35. Bruce S. Cooper and Barbara Hummel-Rossi, *Relicensing Teachers into Math and Science: A Creative, Short-term Solution to the Teacher Shortage* (Paper presented at the 67th annual meeting of the American Educational Research Association, San Francisco CA, April 16-20, 1986), ERIC, ED278106

36. Joseph Mancini, "News Release from the News Bureau of the New York City Board of Education," November 21, 1984.

system, with the cooperation of city officials, started this effort long before various commission reports cited the need for math and science teachers.”³⁷

Decline of Math Scores Continues

Just as in previous years, the students’ entry into the middle grades saw declining mathematics test scores in both 1984 and 1985. In these two years the number of grade 5 students at or above grade level was approximately 64 percent. Those same years saw the number of grade 6 students at or above grade level at about 61 percent and 60 percent respectively. In keeping with the trend, the number of grade 9 students at or above grade level in 1984 and 1985 was the lowest among all grades 2 through 9 students, with 42.2 percent and 38.3 percent respectively.

Table 4-3 (p113) shows the citywide percentages of students at different levels of achievement for the period 1983 through 1985. In 1983, 8.3 percent of students citywide were 2.1 years or more below grade level, however, this fell to 7.8 percent in both 1984 and 1985. Throughout the three-year period about one-fifth of the students were up to one year below grade level, in 1983 it was 21.8 percent; in 1984 it was 21.5; and in 1985 it was 20.7 percent. The fact that more than 20 percent of the students were so far below grade level clearly indicated that the efforts of the chancellor had not been as productive as was desired.

In June 1985 the chancellor, Nathan Quinones, issued a report card on the New York City school system. He did seem to be comfortable with the situation in the public schools, but, while he might have been pleased with his performance, the middle school mathematics scores did not

37. Joseph Mancini, “News Release from the News Bureau of the New York City Board of Education,” November 21, 1984.

show much difference from the previous year, as can be seen from the analysis of table 4-3. The fact that the classrooms continued to be overcrowded, even though he had made an early promise to reduce class size, kept the teachers frustrated, reduced their performance, and maintained the poor performance of the students.

While trying to improve all the other weaknesses in the school system that were identified in the

Citywide Percentages of Pupils at Different Levels
of Achievement in Mathematics on the New York City
Mathematics Test
April 1985

<u>Mathematics Achievement Levels</u>	<u>Percent of Pupils</u>		
	<u>1983</u>	<u>1984</u>	<u>1985</u>
At and Above Grade Level	58.1	59.9	60.2
Up to 1.0 Year Below Grade Level	21.8	21.5	20.7
From 1.1 Years Below to 1.5 Years Below Grade Level	5.6	4.9	5.5
From 1.6 Years Below to 2.0 Years Below Grade Level	4.6	4.3	4.2
2.1 Years or More Below Grade Level	8.3	7.8	7.8
Limited English Proficient Students Excused from Testing*	<u>1.6</u>	<u>1.6</u>	<u>1.6</u>
Total Percent Tested Plus Percent of Students Excused for Limited English Proficiency	100	100	100
Total Number Tested Plus Percent of Students Excused for Limited English Proficiency	428,652	429,667	431,558

*Students excused from testing because of Limited English Proficiency are presumed to score below grade level.

Source: New York City Board of Education, 1985

Table 4-3

school system by his critics, Chancellor Quinones continued with his testing in mathematics of all grades 2 through 8 students. Testing was considered to be most essential in ascertaining the progress of the students. In particular, the performance of the students in grades 6 through 8 were of great concern, as those students had a history of being unable to perform as well as they had done in the earlier grades. The inability to perform well in grade 8 was a serious problem, as it quite possibly could have led to early dropout, or failure to graduate on time in high school.

Deciding to take a bold stand as he faced the mediocre scores of his students, Chancellor Quinones appointed a Commission on Minimum Standards in 1985. The Commission's purpose was to make recommendations on minimum standards for the New York City public schools. It recommended that at least 70% of students in every intermediate school should have met the graduation requirement in mathematics by the end of the ninth grade. The recommendations for grades 7 and 8 were deferred until data on the tests were available. While setting universal standards, the commission acknowledged that there was a wide variation in inputs to schools, and as a result it tried to make output standards sensitive to the differing inputs schools receive.

The Adoption of the Metropolitan Achievement Test (Math)

Even though there was some improvement (an increase of 2.1 percentage points of students at or above grade level between 1983 and 1985), the scores were still unsatisfactory, and, as a result, the low scores and poor performance of many students in middle school mathematics proved to be a constant source of worry to the Board of Education. Many changes were made in an effort to address the situation. One such change was a new mathematics test, the

Metropolitan Achievement Test (MAT), which was adopted in 1986.³⁸ Richard Guttenberg, the Director of Educational Assessment, who had recommended the adoption of the new mathematics test, predicted that there would have been a decline in the test scores because the MAT was normed in 1985, while the previous testing instrument compared the students to a 1976 nationally normed group.³⁹ The MAT, therefore, had newer, tougher norms and was considered a more challenging test. The scores in fact turned out to be much better than he had predicted.

The MAT test was administered in 1986 to a little less than 400,000 New York City grades 2 through 8 students. About 14,000 limited-English proficiency students were excused from testing but were nevertheless included in one section of the report. This was the first time that the Board of Education had reported the results in two forms, one with the LEP students included, and another with them excluded. Table 4-4 (p116) shows both situations. The first is the traditional method of reporting, where LEP students are included. In this case, of the 414,210 students (LEP included), 49.2 percent scored at or above grade level. In the second method, there were 398,682 students (tested students only). Of this number 51.1 percent was at or above grade level. The discrepancy resulted from the fact that all LEP excused students were deemed to be below grade level.

38. There was a change in reporting of the test scores in 1986. Previously the scores were reported as grades 2 through 9. However from 1986 the reported scores were grades 2 through 8. This was because most grade 9 students now wrote the Regents examinations.

39. The national norm for a grade is based upon the mathematics achievement of a sample of students that are representative of the United States student population in that grade.

Table 4-4

Student Achievement in Mathematics on the Metropolitan Achievement Test Grades 2 Through 8 April, 1986		
Percentage of N.Y.C. Students		
National Quartile	Tested Plus LEP-Excused*	Tested Students Only
Quartile 4	26.7	27.7
Quartile 3	22.5	23.4
Total At or Above Grade Level	49.2	51.1
Quartile 2	22.7	23.6
Quartile 1	24.3	25.3
LEP-Excused	3.8	--
Total Below Grade Level	50.8	48.9
Total	100.0	100.0
Total Number of Students	414,210	398,682

* Students excused from testing because of limited-English proficiency (LEP) are presumed to score below grade level.

Source: New York City Board of Education, 1986

Mr. Guttenberg analyzed the 1986 citywide mathematics test results and in his memo to Chancellor Quinones indicated that he had drawn the following broad conclusions from the results of the test:

- When compared with today's youngsters nationwide, approximately half of our students score at or above grade level—which is just what would be expected in a normal distribution of test scores.
- The apparent drop in mathematics achievement from last year must be viewed in the context of the new citywide test—one with much tougher standards.

- Compared with students nationwide, more New York City students score in the high and low ranges, and fewer score in the middle ranges.
- We see great variation in scores from district to district.
- While achievement is quite consistent from grades 2 through 6, there is a sharp drop-off in grade 7; this phenomenon warrants further scrutiny.⁴⁰

Mr. Guttenberg's report indicated that the New York City middle school students performed according to the national norm. Their scores were commensurate with the normal distribution that one would expect of test scores. He blamed the apparent drop in test scores from the previous year on the tougher standards of the Metropolitan Achievement Test. Further, he found that when compared with students nationwide, more New York City students tended to score on the higher and lower range, and fewer on the middle ranges. His other two points, that there was a decline in test scores after the 6th grade and the wide variation in scores from district to district, have already been dealt with elsewhere in this study.

The continued attempts to raise the standard of middle school mathematics in New York City during the 1986-1987 school year did bring some positive results. The authorities succeeded in raising the overall citywide score by 2.3 percentage points. This slight improvement in the scores was regarded as good news by both the board president, Mr. Robert Wagner, and the chancellor. So satisfied was the chancellor that he was quoted as saying, "Over all we've maintained our achievement in reading and math."⁴¹

40. Richard Guttenberg, Memo to Nathan Quinones, New York City Board of Education, August 15, 1986, Series 1125, Box 10.

41. Jane Perlez, "Test Results Are Mixed," *New York Times*, June 18, 1987.

Not everyone was satisfied, however, as Dr. Gwendolyn Baker, a board member, disagreed with the chancellor. She believed that there was a miserable failure in both mathematics and English. She claimed that she was not satisfied with any situation where there were only 40 percent of the students at or above grade level. Dr. Baker was referring specifically to the seventh and eighth grades in which there were 40.7 percent and 42 percent respectively at or above grade level if only the tested students are considered. When the LEP students were included, there were 39.1 percent of the students in the seventh grade and 40.3 of the students in the eighth grade at or above grade level. The Chancellor blamed the poor performance in the seventh and eighth grades on unqualified mathematics teachers in those grades.⁴²

When the results of the 1986 MAT test are compared with the 1987 results (Table 4-5), it will be seen that 49.2 percent of students (LEP included) in 1986 as against 51.5 percent in 1987 (LEP included) were at or above grade level; if the LEP students are excluded (tested students only), then the scores appear somewhat better, with 51.1 percent of the students in 1986 and 53.8 percent of the students in 1987 at or above grade level.

42. Jane Perlez, "Test Results Are Mixed," *New York Times*, June 18, 1987.

Table 4-5

MAT-Math Results for Grades 2 through 8:
1986 and 1987

National Quartile	Percentage of N.Y.C. Students	
	Tested Plus LEP-Excused 1986	Tested Plus LEP-Excused 1987
Quartile 4	26.7	29.7
Quartile 3	22.5	21.8
Total At or Above Grade Level	49.2	51.5
Quartile 2	22.7	22.0
Quartile 1	24.3	22.2
LEP-Excused	3.8	4.3
Total Below Grade Level	50.8	48.5
Total	100.0	100.0
Total Number of Students	414,210	411,527

NOTE: Students excused from testing because of their limited English proficient (LEP) status are nevertheless included in this analysis, and are presumed to perform below grade level.

Source: New York City Board of Education, 1987

A very important point becomes apparent on examination of the individual results of the community Districts (Table 4-6, p121). Here it will be observed that there were wide variations between the scores of various Districts (as pointed out by Mr. Guttenberg). For example, it is worth noting that there was a wide discrepancy between the scores in District 26 in Queens and District 32 in Brooklyn. The explanation given by some authorities for the gap in achievement between the students in these two districts is the difference in wealth between the two districts. While 80.8 percent of the students in District 26 scored at or above grade level in 1986, in

District 32 that figure was only 33.8 percent. In 1987 the gap was a little narrower 82.2 percent in District 26, and 42.5 percent in District 32. District 32 was the lowest scoring overall, but it did in fact make what may be considered an impressive gain of 8.7 percentage points between 1986 and 1987.

The grades 2 through 8 Spring 1988 mathematics test results were considered to be quite good when they were released.

Table 4-6

Districtwide MAT-Math Results:
1986 and 1987

District	April 1986 % At or Above Grade Level	April 1987 % At or Above Grade Level
1	39.5	42.9
2	60.8	62.6
3	36.6	37.8
4	43.6	45.2
5	36.6	38.3
6	37.4	37.7
7	35.3	36.4
8	47.2	49.5
9	37.8	38.8
10	36.8	37.4
11	55.6	60.5
12	38.6	38.0
13	48.9	53.9
14	48.5	49.6
15	51.9	56.2
16	44.4	46.6
17	37.2	40.3
18	56.6	61.4
19	41.2	44.0
20	54.4	55.4
21	55.3	59.1
22	58.7	59.0
23	38.0	41.6
24	50.3	53.0
25	70.7	72.2
26	80.8	82.2
27	50.9	52.9
28	58.2	58.1
29	50.6	54.7
30	54.6	56.7
31	68.2	70.0
32	33.8	42.5
I.S. 227	73.7	77.9
Citywide	49.2	51.5

NOTE: Students excused from testing because of their limited English proficient (LEP) status are nevertheless included in this analysis, and are presumed to perform below grade level.

Source: New York City Board of Education, 1987

Those results showed that 54.8 percent of the students citywide were at or above grade level. This was interpreted as good news by both the board president Robert Wagner and Chancellor Green, as it represented a steady improvement in the mathematics scores over a three year

period. In addition, the reading scores were better than those of the previous year; together these scores served as an indicator of how well the New York City schools were performing.

The most conspicuous theme emanating from the study of the period so far is the fact that there was a persistent gap in the mathematics scores as the students left the elementary grades and entered the middle grades. Throughout the period this pattern consistently occurred. The various chancellors had agonized over this problem; and, as will be shown in Chapter 5, continued to do so. In analyzing the results of the 1986 citywide mathematics test, Mr. Guttenberg particularly mentioned the fact that the students' achievement was quite consistent up to grade 6 but that there was a sharp drop-off in grade 7. This is very similar to the sentiments expressed by Chancellor Frank Macchiarola who claimed that what was being seen was a good sign up to the sixth grade but it was not good after that.⁴³ He was at the time referring to the results of the 1985 citywide mathematics test.

Table 4-7
Percent of Mathematics Students at or above
Grade Level, 1981-1986

Grade Year	6th	7th	8th	9th
1981	52.6%	38.8%	38.6%	29.5%
1982	59.5%	47.1%	49.4%	35.2%
1983	60.1%	47.7%	52.7%	36.4%
1984	60.9%	54.8%	51.1%	42.2%
1985	59.8%	52.9%	51.8%	38.3%
1986	56.9%	39.3%	41.5%	X*

Source: New York City Board of Education Reports of
Mathematics Test Scores, 1981-86

*The 1986 mathematics test results did not include the 9th grade because they now took the Regents (RCT) examination.

43. Gene Maeroff, "Math in City Schools," *New York Times*, May 30, 1981.

The situation referred to by both Mr. Macchiarola and Mr. Guttenberg is clearly shown in Table 4-7. The table shows the scores of the 6th through 8th grade mathematics students from 1981 through 1986. The pattern is quite obvious as the scores in each year are examined. The drop-off described by Mr. Guttenberg occurred every year. The only difference is that some years were worst than others. For example, in 1984 and 1985 the decline was 6.1 percentage points and 6.9 percentage points respectively. On the other hand in 1981 and 1986 the decline was 13.8 percentage points and 17.6 percentage points respectively. Mr. Guttenberg was therefore quite correct in suggesting that the phenomenon warranted further scrutiny.

Shortage of Mathematics Teachers

In 1984 the New York City Board of Education created the Mathematics and Science Re-Licensing Program, a program which took a new approach to replenishing the mathematics and science teachers in the city schools. Rather than seek mathematics and science teachers from outside the system, the board decided to retrain some of the teachers already working within the system; they planned to retool teachers from such overstocked fields as English, history, and elementary education.⁴⁴ There were several advantages which the Board gained from this method of acquiring teachers for the difficult-to-staff disciplines.

The first advantage was that these were experienced teachers who had completed all their education courses and needed no further teacher training. This meant that these teachers were ready to start in their new disciplines immediately. The second advantage was that the Board did not have the high cost of initiating new teachers into a system which they might soon leave. The

44. Bruce S. Cooper, "Retooling Teachers, The New York Experience," *The Phi Delta Kappan*, 68 no.8 (April 1987): 606.

third advantage was that, because the teachers who were being retrained had chosen to do so voluntarily, the Board was assured of a group of devoted and committed teachers. The end result was that the city school system was able to add several trained mathematics and science teachers to its ranks with funding from the City Council, and cooperation from several local universities.

As Cooper and Himmel-Rossi so nicely put it, re-licensing and re-certifying was an exciting short-run possibility. “It applies the bandage directly to the wound; it brings the teachers in the classroom up to speed; and it is economical, since the teachers who are already there, involved, and tested, are provided the tools they need.”⁴⁵ It was indeed a unique model which helped in some small measure to address the shortage of mathematics teachers. The program was funded by the city, had the full cooperation of the UFT, approved by the Board of Education, and managed by the Head of the Division of Curriculum and Instruction, Charlotte Frank. The program brought together 11 universities and colleges in the metropolitan area to participate in the re-training venture.⁴⁶ As a result of the relicensing program 88 new mathematics teachers were added to the New York City school system in the 1985-86 school year.

The teachers benefited by getting a new license at no cost to themselves. The mathematics teachers further benefited from the fact that they could seek licenses for both junior and senior high schools at the same time. The number of mathematics credits required for certification for the junior high school was 18, while 24 credits were required for the senior high school. The program was so designed that a teacher could, if (s)he so wanted, use the first 18 credits towards a junior high school mathematics license and then add another 6 credits in

45. Cooper and Himmel-Rossi, “Re-licensing Teachers into Math and Science,” A Creative, Short-term Solution to the Teacher Shortage, (Paper presented at the 67th annual meeting of the American Educational Research Association, San Francisco CA, April 16-20,1986), ERIC, ED278106, 4.

46. Cooper, “Retooling Teachers,” 607.

calculus for the senior high school license.⁴⁷ These teachers were only required to complete courses in their subject area. For them there were no teaching method courses, no education psychology courses, and no courses in the philosophy of education.

The overall benefit to the school system was that re-licensing did not promote trained and experienced teachers out of teaching, but armed them with new knowledge and a new certificate, one which allowed them to teach in another content area without losing any of their benefits and privileges. It certainly strengthened the pool of resources that was available to service the city's education system. Teachers certified in at least two subject areas were of tremendous benefit to students. Further, re-certification met the immediate and critical need for teachers in the short run and could have been seen as continuing growth and professional development for teachers.

The program was evaluated in 1984 by a distinguished committee and it was found to be quite suitable for its purpose. It was again evaluated during the 1985-86 school year by the Board of Education. The evaluation showed that during that year "100 university-based, credit-bearing courses were offered to teachers in the program." Sixty-two courses had been offered in mathematics and thirty-eight in the sciences.⁴⁸

The measure of the success of the program, however, was the number of teachers who completed the course credits required for state certification in their content area. This success must be weighed against the difficult circumstances under which the teachers had to study. These were people who taught all day, journeyed to class two or three times a week, then returned home at nine o'clock at night to grade papers and prepare lessons for the next day. In addition to

47. Cooper, "Retooling Teachers," 607.

48. Cooper, "Retooling Teachers," , 608.

that, most of them were middle aged and had not studied any mathematics since their high school days. Hence it was no doubt quite a challenging task for them to adjust to this kind of study regimen. Therefore “it was no surprise that a number of participants found the classes difficult, the time forbidding, and were unable to finish the first class.”⁴⁹

The problems encountered in attending these classes caused a little over a third of the participants to withdraw voluntarily or fail the class. There were 622 students entered for classes in the five semesters, from Fall 1983 through Spring 1985.⁵⁰ Of the number of students entered for classes during this period, 212 withdrew or failed; in the Fall 1983-Spring 1984 there were 174 students with at least one passing grade, in Summer 1984 there were 52 students with at least one passing grade, and in Fall 1984-Spring 1985 there were 177 students with at least one passing grade. The data shows an additional 7 students who had at least one passing grade but the dates were unknown.⁵¹

49. Cooper and Himmel-Rossi, Re-licensing Teachers, 14

50. The semesters were: Fall 1983, Spring 1984, Summer 1984, Fall 1984, and Spring 1985.

51. Cooper and Himmel-Rossi, Re-licensing Teachers, 14

Table 4-8
Comparison of Program Teachers and General Population
Teachers Passing Board's Mathematics Licensing Exam

School	Fall 1984			Spring 1985*			Total		
	App. #	Pass #	Pass %	App. #	Pass #	Pass %	App. #	Pass #	Pass %
Jr/Int Sch									
Gen Pop	304	36	12	135	45	33	434	81	18
*Program	36	10	28	27	12	44	63	22	35
Day Hi Sch									
Gen Pop	512	122	24	212	22	10	726	144	20
*Program	24	6	25	45	14	31	69	20	29
Total Sch									
Gen Pop	816	158	19	347	67	19	1160	225	19
*Program	60	16	27	72	26	36	132	42	32

*Spring 1985 data do not include May 1985 exam which was being scored at the time of this report preparation.

Note. App. refers to teachers applying to take the licensing exam and Pass refers to those passing the exam.

Source: Re-Licensing Teachers into Math and Science: A Creative, Short-Term Solution to the Teacher Shortage, Bruce S. Cooper and Barbara Hummel-Rossi, 1986.

Table 4-8 compares the number of teachers in the general population (those who were not in the re-licensing program) who passed the Board of Examiners licensing examination in mathematics to those in the special re-licensing program who passed. From the table it could be seen that of the 434 applicants from the general population who entered for the middle school license, 81 (18%) passed. In the special program, however, of the 63 applicants who entered, 22 (35%) passed. This seems to indicate that the preparation in the re-licensing program was quite adequate when the difficulties experienced by the participants are considered.

Writing in 1985 Levin suggested that because of the sudden attention that was being given to the shortage of mathematics and science teachers, it might have appeared that the issue

was a recent phenomenon.⁵² However, he provided evidence in his paper to suggest that shortages of such teachers had existed for at least forty years, and that the crisis at the time was only a more extreme manifestation of a situation that had its origins in the single salary schedule that had been employed by the schools.⁵³ While the problem of the single salary schedule is well known, there is a major restriction preventing the introduction of a salary differential for teachers in the shortage areas. The problem is that salary differentials required to attract teachers in the shortage areas may rise or fall over time.⁵⁴ Hence the salary scale had to be flexible but such a salary scale is difficult to formulate and problematic to implement.

He recommended that apart from the two most prominent approaches used by state and federal education authorities, retraining of teachers and the provision of scholarships and loans, he strongly recommended that the already mentioned salary differential should be paid to persons who met the required qualifications for teaching mathematics. Retraining, scholarships, and loans by themselves alone were not enough to keep mathematics and science teachers in the school system when there were far more lucrative offers outside of the system. He further argued that the modest level of teachers' salaries may explain much of the problem of inadequate teacher quality.⁵⁵ This low level of salaries is sometimes the fault of both the Board of Education and the teachers union, as was witnessed during the Koch administration in 1985 and documented by *The New York Times*.⁵⁶ The newspaper claimed that the two protagonists dallied

52. Levin, "Solving the Shortage of Mathematics and Science Teachers," *Education Evaluation and Policy Analysis* 7 no. 4 (Winter, 1985): 372.

53. Levin, "Solving the Shortage of Mathematics and Science Teachers," 372

54. Levin, "Solving the Shortage of Mathematics and Science Teachers," 378

55. Levin, "Solving the Shortage of Mathematics and Science Teachers," 378

56. "The Teacher Shortage was Predictable," *New York Times*, August 14, 1985.

for a year over contract negotiations. At that time the starting salary for teachers in the city was \$14,500 which was wholly uncompetitive with neighboring school districts.⁵⁷

The acute shortage of teachers in all subject areas was most evident when New York City public schools reopened in September 1986: more than 2500 new teachers were needed to cover the classrooms. The most desperate shortages were, not surprisingly, in mathematics and science. In fact, about 250 mathematics teachers were needed at that time, and it was expected that the number would triple by 1990.⁵⁸ Most cities in the United States could not fill their openings in the most difficult-to-staff disciplines: mathematics, the sciences, and special education.⁵⁹ New York City was no different in this respect.

So dire was the situation that a survey conducted at around the time found that 25 percent of mathematics teachers in the nation were teaching out of their license area. This was permissible because the law allowed a teacher who was certified in one area to teach not more than two classes a day in another area, particularly if there was a shortage in that area and the school district declared it an emergency.⁶⁰ The situation in New York City was slightly different. Posamentier and Stepelman in their study of high schools in the city found that the number of teachers licensed in subjects other than mathematics who were assigned by their principals to teach mathematics grew from 3% of the entire high school teaching staff in 1972 to 12% in 1981.⁶¹

57. "The Teacher Shortage was Predictable," *New York Times*, August 14, 1985.

58. Cooper, "Retooling Teachers," 606.

59. Cooper, "Retooling Teachers," 606.

60. Cooper and Himmel-Rossi, "Re-licensing Teachers into Math and Science," 5

61. Posamentier and Stepelman, "A Shortage of Mathematics Teachers in New York City," *The Mathematics Teacher* 75 no. 7 (October 1982): 588.

Accountability and Standards in Junior High Schools

In the mid-1970s there was renewed emphasis on accountability in the New York City public schools as a result of the increase (from 14 to 20) in the size of the Chancellor's Monitoring Task Force.⁶² This allowed for an increase in the unannounced visits to the schools by the monitors. According to a report by Chancellor Irving Anker, the concept of system-wide accountability was implemented in November 1974; and although the city's severe financial crisis impeded progress in this area, an accountability plan was ready for launching as soon as funds were available.⁶³ However, he did not elaborate on these plans.

Ensuring accountability for the education of New York City's children rested with the Chancellor's legal authority to set minimum standards of performance for all schools in the city.⁶⁴ However, notwithstanding the fact that the chancellors since 1969 had this authority to set minimum performance standards, none had done so until Chancellor Quinones appointed his Commission to deal with the matter in 1986. It was necessary to identify "clearly defined, measurable, challenging, yet realistic performance standards" so that the mission of the Board of Education to educate all students to their fullest potential could be achieved.⁶⁵

Chancellor Quinones mandated the Chancellor's Commission on Minimum Standards (CCMS) to develop minimum standards for the schools in New York City. The Commission was convened in January, 1986, and was composed of thirty educational leaders from New York City

62. The Schools Monitoring Task Force had the job of visiting schools to ensure that their programs complied with state and federal regulations.

63. Irving Anker, "Five Year Progress Report 1973-1978 , New York City Public Schools," Board of Education of the City School District of the City of New York, 1978, 12.

64. Jody Spiro, *New York City's School Performance Indicators: A Collaborative Process*, March 1988, ED 295946.

65. Jody Spiro, *New York City's School Performance Indicators: A Collaborative Process*, March 1988, ED 295946.

and other places. It included school principals, superintendents, union representatives, representatives from parents' organizations and advocacy groups, and also some private sector leaders. Professor Edmund Gordon of Yale University was appointed chairman of the Commission and Jody Spiro, Chancellor Quinones Executive Assistant was appointed as its Staff Director.⁶⁶ Dr. Gordon in turn employed a small staff of consultants and experts to assist him in making the Commission's work a success.⁶⁷

In its first report to the Chancellor the Commission set out its recommendations on intermediate level mathematics achievement as follows:⁶⁸

- a) The Commission will formulate a standard for student performance on the eighth grade Metropolitan Achievement Test.
- b) The Commission recommends that at least 70 percent of students in every intermediate school should have met the graduation examination requirement by the end of ninth grade. Of these, 25 percent should have met the requirement by passing a Regents Exam in mathematics rather than the Regents Competency Test.
- c) The Commission will formulate standards which will indicate the minimum percent of students in each school who should perform in the top quartile on the

66. Dr. Edmund Gordon served as chairman of the Chancellor's Commission on Minimum Standards. Also included in the Commission were thirty educational leaders from New York and elsewhere. These were school superintendents, principals, union representatives, representatives from parents' organizations and educational advocacy groups. Dr. Gordon selected a small staff consisting of Dr. Ernest Washington, Dr. Dawn Arno, Julia Friedlander, and Lynn Yanis. Jody Spiro served as Staff Director.

67. Spiro, *New York City's School Performance Indicators*, 5.

68. Report to the Chancellor from the Commission on Minimum Standards, *Progress Report* New York City Board of Education, February 1987, 23, New York City Municipal Archives, Series 1125.

Metropolitan Achievement Test (MAT) in grades 2 through 8 and the maximum percent of students who should perform in the bottom quartile.

- d) The Commission will formulate progress standards for the MAT which will indicate the expected amount of change in student performance from one test date to the next.

The Commission held several meetings over a year; and in a letter to Chancellor Quinones dated March 5, 1987, the Chairman, Edmund Gordon, outlined how the Commission intended to proceed for the next several months. The letter also indicated that the Commission had structured its agenda around three project and work areas: implementation, staff and institutional or input standards, and assessment techniques.⁶⁹ These were to be pursued in different ways. A subcommittee was to be convened a little later to review literature which addressed approaches to qualitative school assessments. It was decided by the Commission that work in that area would remain on the long term agenda.

Another subcommittee was to be convened to begin work immediately on the staff and institutional standards aspect of the agenda. The plan for this subcommittee was to analyze the distribution of various staff and institutional characteristics throughout the city schools. This aspect was considered urgent because the distribution of various characteristics of staff and institutions in the New York City schools was closely related to the subject, implementation and monitoring, on which the commission had focused most of its discussion time at one of its retreats.

69. Edmund W. Gordon, Letter to Nathan Quinones, Chancellor, New York City Board of Education, March 5, 1987, New York City Municipal Archives. Series 1125.

Although it attempted to set rigorous standards, the Commission showed that it was sensitive to the needs of the diverse student population of the City. Also, it was cognizant of the fact that it was necessary to develop standards to consider the link between school outcomes and the inputs the schools receive. As a result of this recognition, in its report to the Chancellor in February, 1987, it explained, “We have tried to make output standards sensitive to the differing inputs schools receive, without sacrificing the capacity of standards to produce change. The Commission believes that setting lower expectations for schools with inadequate inputs and a history of low expectation will reinforce the existing system.”⁷⁰

These efforts were in keeping with the national consensus on standards. The 1983 Report from the National Commission on Excellence in Education (NCEE), *A Nation at Risk*, portrayed such an unpleasant picture that a complete review of the national education standards in general, and mathematics and science education standards in particular, were considered to be of paramount importance. As a result of all that was happening nationally, and the dissatisfaction locally with the students’ performance in mathematics, the chancellor did what he felt was necessary to improve the standards in the school system. The appointment of the Commission to make recommendations on the minimum standards was part of this effort.

Summary

There were two major events in the early years of this period. The first was the backlash against the “new math.” This chapter examined the reasons for the backlash against the “new math” and the call to go back to basics. There were several reasons for this, chief of which was

70. Report to the Chancellor from the Commission on Minimum Standards, February 1987, 1 New York City Municipal Archives, Series 1125.

the displeasure of many people in the mathematics community who were dissatisfied with the “new math” curriculum. They felt it did not meet the needs of the students. To them the “new math” curriculum was too abstract and not sufficiently grounded in real life situations.

The second major event was the severe budget cuts which affected the ability of the board to provide quality education for the students. From 1972 to 1988 there was a series of attempts to address the weakness of the middle school students in mathematics. Much of these efforts were, however, (at least in the early years of the period) seriously restricted by the austerity measures which the New York City Board of Education was forced to implement. The consequences of these austerity measures were wide and far reaching. Students were affected by the fact that class size was larger, and teachers were affected because many of them were retrenched. Also, there was less professional development for them and less school supplies were available for use in the schools. In short, the educating of the city’s children proceeded with a severely reduced amount of the facilities that were required for the task.

Middle school mathematics in the city suffered terribly as a result of the chronic shortage of mathematics teachers and the persistent weakness in the subject by the students. Because there was a shortage of qualified mathematics teachers, professional development in mathematics content and pedagogy was sorely needed by the inexperienced mathematics teachers who taught the classes and by those who were teaching out of license. These programs were severely restricted by the already mentioned earlier budget cuts.

The efforts by chancellors in the latter part of the period appeared to be more productive, in part because they were not constrained by the severe budget cuts which their predecessors experienced. This allowed for a new mathematics test, the Stanford Diagnostic Mathematics Test, to be introduced by Chancellor Macchiarola to all grades 2 through 9 students in 1981 and

the Metropolitan Achievement Test (MAT) to be introduced by Chancellor Quinones in 1986. These standardized tests were used to gauge the progress of the students in mathematics in the elementary and middle grades.

An examination of the results of these various tests indicates that while there was some small measure of improvement in the scores of the students in the elementary grades, the pattern of decline continued in the middle grades. This decline is shown quite clearly when the scores of the students in the elementary grades are compared with those in the middle grades, particularly the 7th grade. As students moved up through the middle grades their scores tended to decline. This was a source of worry to the New York City education authorities because of its persistence and the fact that it defied all efforts to correct it.

Another important issue that was raised in this chapter is the continued shortage of qualified mathematics teachers in general, and junior high school mathematics teachers in particular. As made clear, this shortage led the Board of Education to develop very novel ideas to solve the problem. The Board's Mathematics/Science Recertification Program which ran from fall semester 1983 through spring 1985 was one such program. This program placed 88 new mathematics teachers in the New York City system. However, it is not known how many of these new teachers went to the junior high schools.

From all that has been discussed it can be seen that the 1972-88 period was quite eventful. The dissatisfaction with the "new math" curriculum in the early 1970s, the severe financial crisis in the mid-1970s, and the introduction of new standardized mathematics tests in the 1980s were all events which impacted the New York City public school system. The fact is, however, that notwithstanding all the above, the problem with the middle school mathematics continued. Hence, as will be discussed in Chapter 5, it was hoped by the proponents of the

Standards Movement that standards reform would serve as a panacea for all the ills that affected mathematics education not only in New York City but in the nation as a whole.

CHAPTER FIVE

MIDDLE SCHOOL MATH IN NEW YORK CITY 1985-2002

Introduction

A major concern of the education authorities in New York City during this period was the conspicuous drop-off in scores as the students left the 6th grade and entered the 7th grade. This situation continued from the previous period that was discussed in Chapter 4. For example, in the years 1987 through 1990 the drop-off in scores was:

1987	17.7 percentage points
1988	11.4 percentage points
1989	16.4 percentage points
1990	10.1 percentage points

Over the years many chancellors have tried to no avail to bring about a change. However, while this was the major focus, there were many other issues—standards reform, poor performance of mathematics students, teacher shortage---affecting mathematics education both nationally and locally.

In this chapter I analyze the arguments for and against standards reform. The great debates on this issue were mainly based on three important questions concerning students. (a) What should students learn? (b) Who should decide what students learn? (c) What tools should be used to measure students' progress?¹ Of course these questions led to the philosophical question: What is the purpose of education? This question in fact goes back to the ancient

1. Ravitch, *National Standards in American Education*, 136

Greeks, when Socrates argued that education was about drawing out that which was already in the student. In the late 20th century this question was increasingly disputed.

Standards reform was seen as the way forward in mathematical education. Thus New York City joined the Standards crusade as two of its chancellors in the 1980s, Nathan Quinones and Joseph Fernandez, sought to have mathematics standards developed for the schools in the city.² Also, during the subsequent tenure of both Chancellors Rudolph Crew and Harold Levy, the Board of Education made some effort to upgrade New York City school standards in order to bring them in line with the New York State standards.³

I also discuss the attempts by the New York City Board of Education to set instructional guidelines for the teaching of mathematics in the middle schools in the city through its various “Mathematics-Scope and Sequence” publications. The reason given for the revision of the mathematics curriculum was that it needed to meet the needs of a changing society as the nation was moving from an industrial to an information society.⁴ The new Scope and Sequence was intended to reflect this change, even though there were still some aspects of the traditional mathematics retained in the lesson plans that were developed for the teachers.

However, in spite of all the effort, the poor performance of the students in the middle grades (portrayed in Chapter 4), continued unabated. The greatest concern was the drop-off in scores as students moved from the 6th grade to the 7th grade so I provide comparisons to highlight the continuous trend. Even with the best efforts of all concerned, the problem appeared to be

2. “Commission on Minimum Standards,” Report to the Chancellor, February 1987, New York City Municipal Archives, Series 345, Box 11, Folder 117;. New York City Board of Education, Fernandez Announces Reform of Mathematics Education, 1990, New York City Municipal Archives. Series 345, Box 11, Folder 117.

3. Rizzo, Standards Are Not Enough: Challenge of Urban Education, 2003, 201.

4. Warner, Foreword to *Draft 1988 Mathematics Scope and Sequence, Grade 6*, 1988.

resistant to any solution. I also analyze the results of the various city-wide tests, and I show that, as has consistently been the trend, the elementary grades scored far better than the middle grades in all these tests.

This study would be incomplete if I did not discuss the various critics of the reform curricula. There was major opposition to the reform curricula from two main sources. The first was NYC HOLD (Honest Open Logical Debate on Mathematics Education Reform), which was a consortium of parents, educators, mathematicians, and scientists. The second source of opposition to the new curricula was a website called *Mathematically Correct*, which claimed to be devoted to the concerns raised by parents and scientists about the invasion of their schools by the “new-new math” and the need to restore basic skills to mathematics education. Members of NYC HOLD made use of the opportunity offered by the *Mathematically Correct* forum to explain their position nationally.

Another important issue that I discuss in this chapter is the problem of the teacher shortage. Because of this shortage the city was forced to employ a large number of uncertified teachers. This practice, however, met with disfavor from the New York State Board of Regents, and in 2000 the Board sued the city to require certified teachers in every classroom in all failing schools.⁵ As a result three major programs aimed at alleviating the problem of the shortage of mathematics teachers in New York City were started, two of them just prior to the lawsuit (perhaps in anticipation of it), the other just after the lawsuit.

⁵ Mills v. Levy, Supreme Court of the State of New York, Consent Order No. 26190/00 August 24, 2000.

The Standards Movement Era

As was discussed in Chapter 2, this period became known as the period of the standards movement because of the new initiatives towards the setting of national standards in mathematics education. The standards movement was a reaction to what was considered by some in the mathematics community to be the lack of conceptual understanding by mathematics students and the disorganized state of mathematics education in the country.⁶ The proponents of traditional mathematics argued for a curriculum which focused on computation, while their opponents argued for a curriculum which led to a deeper understanding of mathematics. A similar argument had taken place two decades previously during the period of the “new math” (as discussed in Chapter 3) and as a result the curriculum which was developed based on the standards became known as the “new new math.”

Put simply, the major contention revolved around whether to teach algorithm or concept. The reformers felt that while many students were able to complete the mathematical manipulations, they did not understand the mathematics. One question that appeared on a test paper at the time, quoted in the *New York Times*, serves to illustrate the point. “If a bus holds 36 soldiers, how many buses do 1,128 soldiers need? Seventy percent of the students did the long division correctly; yet few got the right answer: 32 buses. More common was the answer ‘31, remainder 12.’”⁷ According to the article quoted above, “back to basics” advocates would focus on the thirty percent who could not divide 1128 by 36, while their opponents would be

6. Fey and Graeber, From the New Math, 549-50

7. Rothstein, *Lessons; A Teacher in the Trenches of the Nation's Math Wars*, April 12, 2000.

concerned about those who did not understand that the remainder “12” required a whole bus with 24 empty seats.

This, then, was the problem which the proponents of the “new new math” claimed that was addressed by the reform. According to them, the purpose was to stress the “whys” rather than the “hows” of mathematics and to de-emphasize the drill and rote learning that had been the substance of traditional mathematics education. A focus on computation versus a focus on concept was the center of the debate. As a matter of fact NCTM strongly argued that the emphasis on paper and pencil skills and a simplistic form of evaluation “have effectively separated students from mathematical reality, inquiry, and intellectual growth.”⁸

Partly out of the fear aroused by the two publications early in the 1980s—*An Agenda for Action* by the National Council of Teachers of Mathematics (NCTM) in 1980 and *A Nation at Risk* in 1983 by the National Commission on Excellence in Education---and partly because of the consistently low scores obtained by students in mathematics, a national debate occurred about the development of national standards in mathematics education. This debate was quite spirited at times because the very idea of national standards was seriously criticized by many people.⁹ However, a trend later appeared to have developed towards a general acceptance of some form of a national mathematics curriculum. New York City was influenced by this emerging trend towards a national curriculum, and it tried to reform its mathematics curriculum to bring it in line with the national consensus.

8. NCTM, Introduction to *Curriculum and Evaluation Standards*, (Working Draft), 1987

9. Ravitch, Introduction to National Standards in American Education, 1995.

At the heart of the debate were several questions. The first was, what should students know in mathematics? The answer to this question depended on what was considered to be the purpose of mathematics education. There was the general belief that students were not learning enough mathematics to be able to function effectively in the workplace. Even those students who understood the traditional mathematical procedures were found to be quite weak as problem solvers and were not as efficient as they could be on the job. As a result many employers demanded that the curriculum be reformed to meet the needs of the students. NCTM took the lead in this respect and helped to point reformers in a new direction.¹⁰

The question of what students should learn is really one that deals with content standards. Content standards describe in detail what is to be taught by the teacher and what the students should learn. As Diane Ravitch suggests, “they provide clear, specific descriptions of the skills and knowledge that should be taught to students.”¹¹ Without clear content standards each teacher in each school would have to determine what the students need to learn. In such a situation teachers would be given a great deal of discretionary powers in the selection of material for their students.

The second question in the debate on the direction that education should take was, who should determine what students learn? To answer this question it is necessary to understand the shift in influence within the mathematics education community. In the last two decades of the century the National Council of Teachers of Mathematics regained the leadership role in preparing content standards for mathematics education in the United States. Its publications have

10. Walmsley, *The History of New Mathematics*, 2003, 91; Fey and Graeber, *From the New Math*, 552.

11 Ravitch, *National Standards in American Education*, 12

served as guides for many state curriculum developers.¹² Traditionally it was the local authorities and the states who determined what their children should learn.¹³ This was now changing. More and more the development of local standards appeared to be guided by national views. As a matter of fact, Ravitch believed that standards were becoming international, particularly in science and mathematics because “these subjects are truly international in scope.”¹⁴

The third question was, what instruments were to be used to measure whether the students had learned what they were supposed to learn? Put another way, what assessment tools should be used to gauge the level of performance of the students? The third question is more involved than the first two. Here there were two issues that had to be decided; the first had to do with the type of assessment tools—tests, projects, or portfolios—to be used, and the second dealt with the level of the students performance—A, B, C, or level 1, or level 2—that was acceptable.

The New York City Performance Standards helped to clarify the issue of student assessment. It indicated that a convenient distinction separated informal, ongoing classroom assessment from formal standardized assessment. The former consisted of evidence teachers collect in class on a continuous basis to track the progress of their students, and the latter consisted of the tests and on-demand assessments administered to all students in specific grades as a part of statewide assessment programs.¹⁵ NCTM argued that both forms of student assessment should be used.¹⁶

12. Walmsley, *The History of New Mathematics*, 2003, 98.

13. New York State Education Department, *Federal Education Policy and the States, 1945-2004: A Brief Synopsis*, 2006,

14. Ravitch, *National Standards in American Education*, 10

15. New York City Board of Education, *Introduction to Performance Standards*, 1998, 10

16. NCTM, *Principles and Standards for School Mathematics*, 2000, 23

New York City Responds to Standards

New York City found itself grappling with the issues raised and discussed in the previous section during this period. As a result the New York City Board of Education tried to deal with these questions by getting its Curriculum Development Division to prepare a series of Scope and Sequence to be used by teachers. Through the Scope and Sequence series the board was able to maintain uniformity throughout the system by preparing lessons plans to guide its teachers.

Both Chancellor Nathan Quinones, who served from 1984 to 1987, and Chancellor Joseph Fernandez, who served from 1990 to 1993, made efforts to upgrade the standards during their tenure. Mr. Quinones appointed the Chancellor's Commission on Minimum Standards (CCMS, already discussed in Chapter 4) to develop minimum standards for the schools in New York City in 1986. In an attempt to raise the standards in mathematics education in New York City,¹⁷ Mr. Fernandez also appointed a Working Group on Mathematics Education in 1989. Almost as if he were acting in concert with the National Council of Teachers of Mathematics (NCTM), a year after it published *Curriculum and Evaluation Standards for School Mathematics* in 1989, Mr. Fernandez presented the report of the Working Group entitled *Mathematics Education in New York City: What It Is; and What It Should Be* to the Board. In releasing the report, Chancellor Fernandez claimed that he was particularly enthusiastic about New York City's participation in the national movement to reform mathematics education. As a matter of fact, the Report strongly recommended the establishment of "consistent curriculum objectives for

17. The members of the Chancellor's Working Group were: Frances Curcio, Queens College; Raymond Durney, Lehman College; Roberta M. Elsenberg, Beach Channel High School; Gerald Elgarten, City College; Gil Lopaz, Columbia University; Joel Marcus, Forest Hills High School; Ronald Moore, Shearman Lehman Hutton, Inc.; Phyllis Pullman, Marie Curie JHS 158Q; Nancy S. Ticktin, Bankers Trust Company; Ronald Woo, NYC Public Schools Office of Recruitment and Counseling; Susan Zakaluk, NYC Public Schools, Director of Mathematics. Chancellor's Working Group, *Mathematics Education in New York City*.

all New York City mathematics instruction that reflect the vision of the National Council of Teachers of Mathematics as stated in their Curriculum and Evaluation Standards for School Mathematics (1989).”¹⁸

In 1990 the Working Group set up by Chancellor Fernandez found that the instruction in New York City’s public schools was overemphasizing computation. The Working Group claimed that most of what was being taught and tested in school mathematics programs was calculation and speed of computation.¹⁹ This was contrary to what had been advocated by the National Council of Teachers of Mathematics in its publication on Standards. As a matter of fact the NCTM in its report complained about that very problem. The Council believed that most mathematics programs failed to reflect the impact of the technological revolution affecting society. It then further recommended that calculators and computers be used in the classroom to solve mathematical problems.²⁰

The Chancellor, in a memo to the Board when seeking to implement the recommendations in 1991, said that the report challenged the New York City school system to:

- a) raise standards and expectations for all students;
- b) improve supervision of mathematics instruction at lower grade levels;
- c) improve professionalism of mathematics educators;
- d) base mathematics curriculum objectives on the standards developed by the National Council of Teachers of Mathematics;
- e) expand parent involvement in mathematics education; and
- f)

18. Chancellor’s Working Group, Mathematics Education in New York City, 1990, 25, New York City Municipal Archives, Series 345, Box 11, Folder 117.

19. Chancellor’s Working Group, Mathematics Education in New York City, 1990.

20. NCTM, Introduction to Curriculum and Evaluation Standards (Working Draft), 1989, 4

enhance mathematics achievement of students with limited English proficiency or with different handicaps.²¹

The first recommendation of the Working Group was of major concern, since mathematics scores had been falling for some time, particularly in the middle grades. In an effort to act upon this recommendation it was decided by the Working Group that, “Attention at the junior high school and high school levels will be redirected to Regents-level sequential Mathematics, which covers algebra, geometry, and trigonometry in an integrated curriculum.”²² The intention was to prepare students in the junior high schools to be able to take at least three years of mathematics, including Sequential Course One, and to pass the Regents Sequential One in order to graduate high school. It was, therefore, a matter of urgency for the Chancellor.

Chancellor Fernandez therefore directed his staff to prepare an implementation plan so that the recommendations of the report could be acted upon immediately. He requested that the implementation plan identify specific activities and responsibility centers for those activities. The plan was also to establish timelines for the completion of these activities. In this way New York City’s mathematics education system was placed among those that were in the forefront of the standards movement. It is worthy of note that the Chancellor’s report echoed the views of the participants at the national education summit of governors summoned by President George H. W. Bush in Charlottesville, Virginia, in 1989. This group set out to establish national goals, not only for mathematics, but for education as a whole. It would seem, therefore, that the vision for

21. Joseph A. Fernandez, memo to the New York City Board of Education, June 4, 1991, New York City Municipal Archives, Series 345, Box 11, Folder 115.

22. New York City Board of Education, Fernandez Announces Reform of Mathematics Education, 1990, New York City Municipal Archives, Series 345, Box 11, Folder 117.

mathematics education in New York City was very much in line with the prevailing ideas at the time.

In the continuing attempt to develop appropriate standards for its school system, the Mathematics Unit of the Division of Instruction and Professional Development of New York City tried to establish consistent curriculum objectives for all New York City mathematics instruction that reflected the vision of the National Council of Teachers of Mathematics in its *Curriculum and Evaluation Standards for School Mathematics*. For many years New York City had been seeking a new direction for its mathematics curriculum. Since it provided the guidance and direction for which they had sought so long, it is not surprising that curriculum developers in the City found the work of the NCTM to be a useful model. The concerted effort by the City's school system to establish mathematics standards appears to have been based on the finding that just under half of the students in the middle grades were failing the citywide mathematics tests, even though it was claimed by the chancellor that it was an effort to "participate in the national movement to reform mathematics education." In fact participation in the national mathematics education reform movement might have been only one of two reasons for the City's plan to reform its mathematics curriculum. The other, and perhaps more pressing reason, can be seen when the mathematics test scores are examined. It becomes clear that the reform of mathematics education in New York City was a matter of urgency to stop the decline of scores in the middle grades generally, and more particularly, the drop-off in scores between the 6th and 7th grades.

Consistent Decline in the Middle Grades

It was noted that the performance of the elementary students consistently exceeded that of the students in the middle grades. Although many conjectures have been raised as reasons for the drop-off, no systematic investigation has been made.²³ The spring 1989 report by the chancellor suggested that this might have been as a result of the differences in emphases at these two school levels, or perhaps, “a host of other organizational and developmental factors.”²⁴ In its continuing attempt to solve this problem New York City decided to follow the recommendations of the National Council of Teachers of Mathematics grades 5-8 standards, which called for a much broader range of mathematical topics than had been studied in the past.²⁵ The traditional emphasis on computational facility was replaced by the application of computational ideas in studying statistics, probability, geometry, and measurement. This change was an effort to move mathematics education closer to what was considered the way forward.

23. Chancellor’s Working Group, *Mathematics Education in New York City*, 1990, 11.

24. New York City Board of Education, *Citywide Test Results, Spring 1989*, 6, New York City Municipal Archives, Series 391, Box 27, Folder 416.

25. NCTM, *Curriculum and Evaluation Standards*, 1989, 52

Table 5-1
 Percent of Mathematics Students at or above
 Grade Level, 1986-91

Year \ Grade	6th	7th	8th
1986	56.9%	39.3%	41.5%
1987	58.4%	40.7%	42.0%
1988	57.7%	46.3%	41.7%
1989	58.0%	41.6%	41.3%
1990	56.0%	45.9%	39.4%
1991	63.7%	50.5%	43.8%

Source: New York City Board Of Education Reports of
 Mathematics Test Scores, 1986-91

*From 1986 the mathematics test results did not include the 9th grade because they now took the Regents Competency (RCT) examination.

Table 5-1 clearly shows the drop-off in students' mathematics scores between 6th grade and 7th grade and the reason for the concern. As indicated below, in four of the six years examined the drop-off was more than 16 percentage points (in 1991 it was almost 20 percentage points). This was certainly a cause for alarm since the problem appeared to have no solution. Clearly an intervention of some sort was needed to arrest the unfortunate and persistent drop-off. A summary of the drop-off from 1986 through 1991 shows that in

1986	17.6 percentage points
1987	17.7 percentage points
1988	11.4 percentage points
1989	16.4 percentage points
1990	10.1 percentage points
1991	19.2 percentage points

Hence of great concern to New York City's education system was the consistent decline in mathematics achievement in the middle grades (see Figure 5-1, p 149). Not only was there a gap in the mathematics scores between elementary and middle school, but more students fell below grade level as they moved up in middle school. The results of the Metropolitan Achievement Test-Mathematics (MAT-Math) that was administered to 405,314 grades 2 through

8 New York City students in April 1988 help to confirm this finding. The results of this test are shown in Table 5-2 p148. The results included scores for both the English and translated versions of the test. In 1988, 57.7% of grade 6 students scored above grade level; 46.3% of grade 7 students scored above grade level; and 41.7% of grade 8 students scored above grade level. Following the same trend, the elementary grades scored far better in this test. In grades 2 through 5 just above 60% were above grade level. Citywide, the percentage of grades 2 through 8 students scoring at or above grade level was 56.7%, an increase of 2.9 percentage points over the 1987 score, and an increase of 5.6 percentage points over the 1986 score.

In April 1989, almost half a million grades 2 through 8 students in New York City public schools took the MAT-Math test. The test that was administered was customized to reflect closely the content and emphasis of New York City's mathematics curriculum while maintaining the difficulty level of the shelf test and the validity of the national norm. Of the 414,180 students who took the test, 56.2% scored at or above grade level (i.e. the 50th percentile).²⁶ From both Table 5-2 and Figure 5-1 it can be seen that there was a modest overall increase in scores over the four-year span between 1986 and 1989. However, it is interesting to note that while the scores at the elementary grades were encouraging, the scores in the middle grades fell between grades 6 and 9. According to the Board's Report the relatively low scores in the middle grades underscored the need for emphasis at these grades, and "the need for continuity in instruction and

26. These statistics were based on the 1985 norms.

Table 5-2

(Tested Students Only)

Grade	Percent At or Above Grade Level			
	1986	1987	1988	1989
2	56.6	59.5	62.3	60.3
3	49.4	54.2	61.8	59.3
4	57.8	59.5	62.1	64.5
5	55.3	60.0	62.6	65.4
6	56.9	58.4	57.7	58.0
7	39.3	40.7	46.3	41.6
8	41.5	42.0	41.7	41.3
Citywide	51.1	53.8	56.7	56.2
Number Tested	398,682	393,941	405,314	414,180

NOTES: Includes scores for both English and translated versions.
Results are based on 1985 norms.

Source: New York City Board of Education Spring 1989 Citywide Mathematics Tests Results.

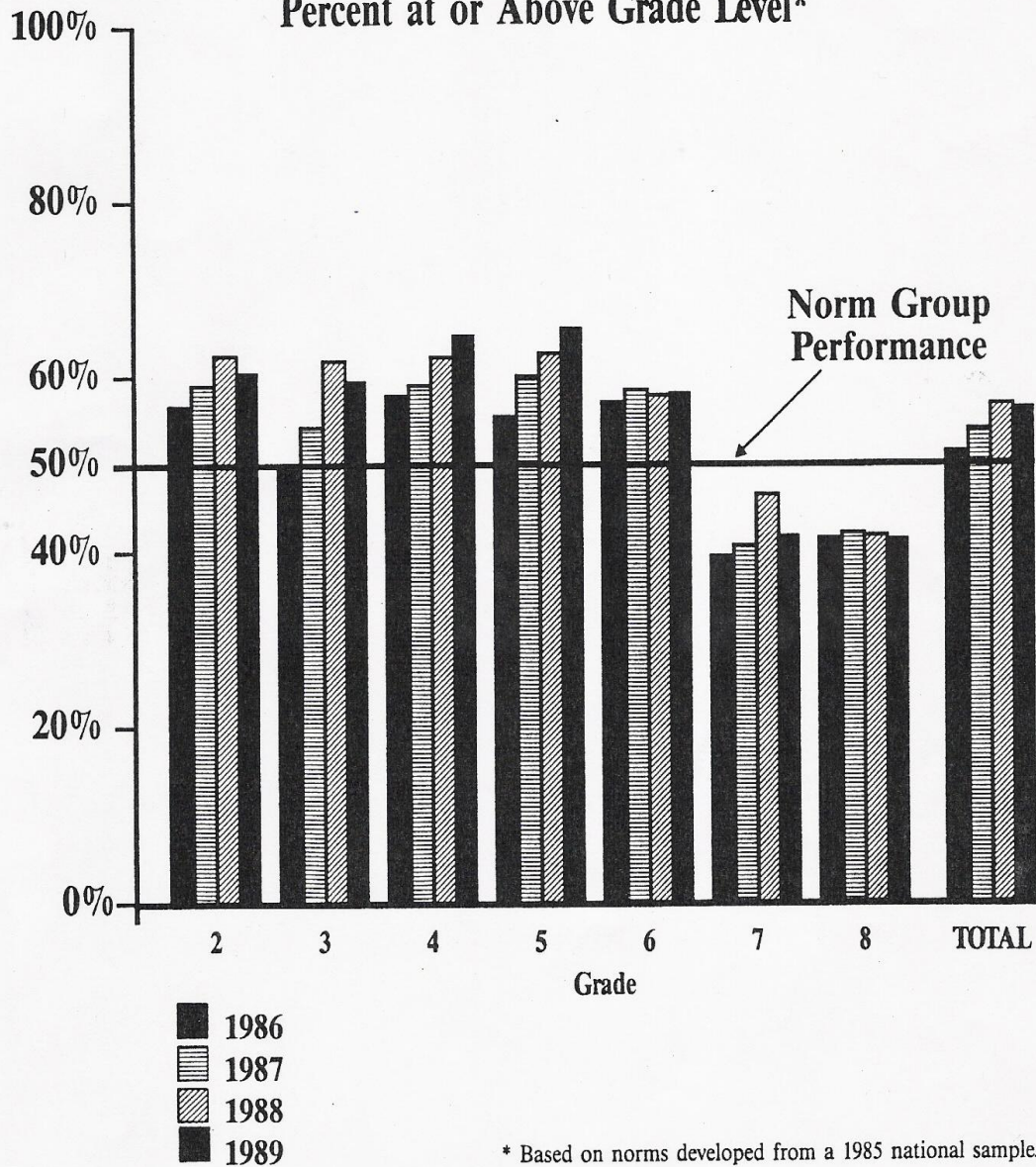
methodology as students leave the elementary schools to enter intermediate and junior high schools.²⁷

27. New York City Board of Education, Citywide Test Results, Spring 1989.

MAT-Mathematics 1986-1989

Total Test

Percent at or Above Grade Level*



* Based on norms developed from a 1985 national sample.

Source: Report of Chancellor's Working Group on Mathematics
Education, June 1990

Figure 5-1

Two factors must be considered when comparing the 1989 figures with those of the previous years. The first is the fact that the policy about the handling of the limited English

proficiency (LEP) students who were exempted from testing was changed. In the past these students were included in the Report of the test scores as below grade level. In 1989, however, only the scores of the tested students were reported.²⁸

The second factor is that it was only since 1988 that translated versions of the tests were administered. In that year translations were available in five editions: Spanish, Chinese (traditional and simplified characters), French, and Haitian-Creole. Hence, according to the Report of the test results, it was considered too early to be certain that the “characteristics of the students taking the translated versions in 1988 are similar enough to those taking them in 1989 to warrant direct comparison.”²⁹

The change to the new method of reporting the mathematics test results was done in an effort to provide a more accurate picture of the achievement levels of the students who were actually tested. In the Overview of the 1989 test results it was claimed that the question of whether or not to include or exclude LEP-exempt students became increasingly moot as test translations “enable us to test students that couldn’t be assessed before, significantly decreasing the percentage of LEP-exempt students.”³⁰

Overall Math Scores Improve in Grades 2-8

The *Daily News* of Wednesday, June 19, 1991, carried a bold caption, “Math scores at 6-yr. high.” According to the story Chancellor Joseph Fernandez had said the day before that more than 60% of second through eight graders had scored at or above grade level in the latest

28. Because of the change in reporting the test scores a higher percentage of students are shown to be above grade level than before. This could be deceptive.

29. New York City Board of Education, Citywide Test Results, Spring 1989, 5.

30. New York City Board of Education, Citywide Test Results, Spring, 1989.

citywide math exams. He claimed that it was the best results in six years. The newspaper quoted him as saying, “This is a very good sign that maybe we’ve started to make a turn from decades of decline.”³¹ There was every reason to be jubilant, since only one year earlier on June 25, 1990, the New York City Board of Education Division of Public Affairs had released a statement lamenting the state of mathematics scores in the junior high schools.³²

Although the chancellor appeared to be quite ecstatic about the 1991 test scores, when they are scrutinized more closely it will be seen that there should have been a more sober approach. A careful study of Figure 5-2, p 154 indicates that while there was indeed an overall increase in the scores, and the 7th grade students did in fact show a modest increase over the performance of those in 1989 and 1990, just 50% barely got to grade level in 1991. In the case of the eighth grade students, however, only 45% scored at grade level. Although this was somewhat of an improvement over the 1990 performance, it was, however, a progressive decline from the 6th grade performance. This fact was identified in 1990 by the Chancellor’s Working Group in their report,³³ *Mathematics What It Is and What it Should Be*.

The preliminary test results for 1991 indicated that citywide there was an increase of 4.9 percentage points from 1990, and 5.2 percentage points from 1989. Overall, 60.6 percent of students scored at or above their grade level. The report further showed that two year increases of more than five percentage points, from 1989 to 1991 were seen for grades 5, 6, and 7. The gains, according to the report, could have been accounted for by a number of reasons: 1) the

31. Evans, “Math scores at 6-yr high,” Daily News, June 19, 1991

32. New York City Board of Education, Press Release by the Division of Public Affairs, New York City Board of Education, 1990, New York City Municipal Archives, Series 391, Box 34, Folder 524.

33. Chancellor’s Working Group, Executive Summary to Mathematics Education in New York City, June, 1990.

examinations were held over two days for the first time; 2) it was the reflection of the new curriculum material; 3) it was the result of increased staff training. More likely, it was a combination of all three. The new curriculum materials and staff training referred to were provided for teachers and students in grade 6, beginning in 1989; for grade 7, beginning in 1990; and for grade 8 beginning in the 1991 school year.

Of the 437,748 students who took the test in spring 1991, about 416,186 took the English language version, while the other 21,562 took the translated form which was available in Spanish, Chinese, French, and Haitian-Creole. All the various language versions of the test were similar in their level of difficulty and were scaled together using the MAT national norms system so that all forms were equivalent and could be combined for analyses.³⁴ It was now possible to test nearly every student and so the number of LEP-exempt students was minimal.

Figure 5-2 p 154, provides a graphic representation of the data for the three year period. A horizontal line is drawn at the 50th percentile mark which represents the grade level standard based on the 1985 MAT national norm. From this graph it can be clearly seen that students in grades 2 through 6 scored well above their grade level standard for the three year period.

34. New York City Board of Education, Citywide Test Results, Spring 1991, 2, New York City Municipal Archives, Series 345, Box 11, Folder 115.

Table 5-3

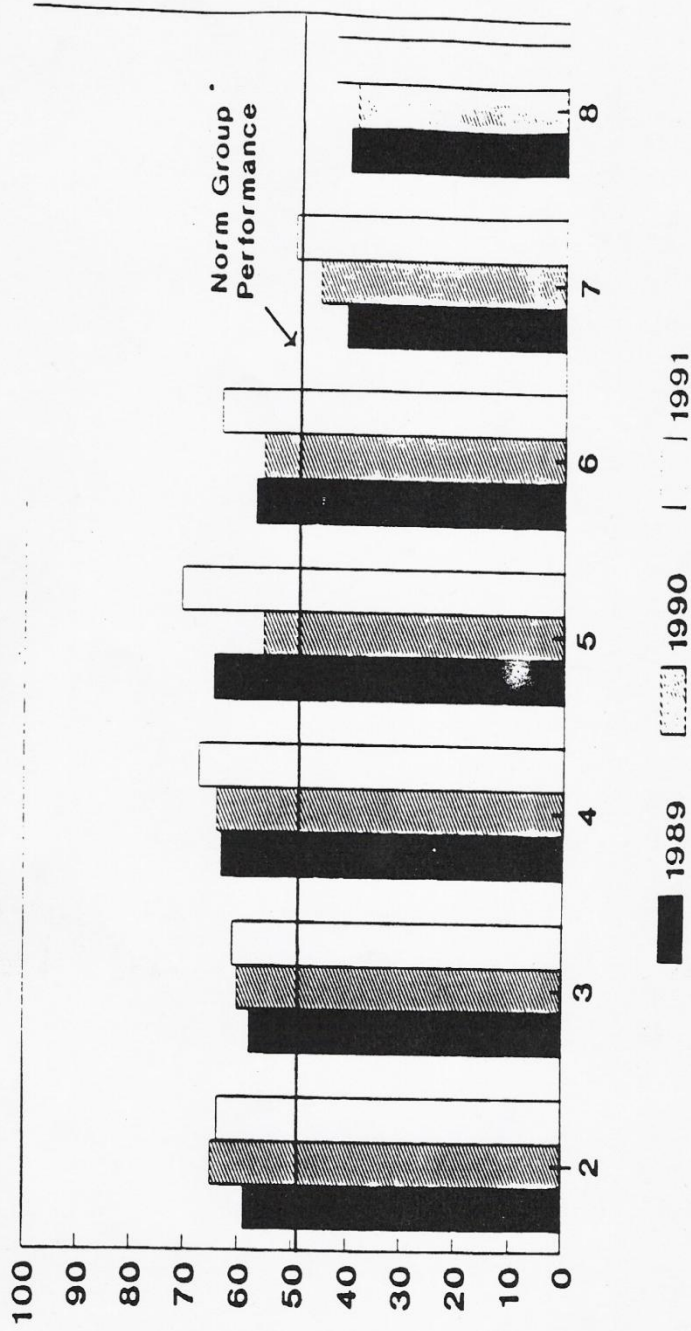
MAT-Mathematics Results by Grade: 1989-1991
(Tested Students in General Education
and Resource Room Programs)

Grade	<u>Percent At or Above Grade Level</u>			Change	
	1989	1990	1991	1990 to 1991	1989 to 1991
2	59.0	65.1	63.9	-1.2	4.9
3	58.1	60.4	61.3	.9	3.2
4	63.5	64.2	67.5	3.3	4.0
5	65.0	55.8	70.9	15.1	5.9
6	57.5	56.0	63.7	7.7	6.2
7	41.1	45.9	50.5	4.6	9.4
8	40.8	39.4	43.8	4.4	3.0
Citywide	55.4	55.7	60.6	4.9	5.2

NOTES: Includes scores for both English and translated versions, administered in regular and make-up test sessions. Results are based on 1985 national norms for the Metropolitan Achievement Test in Mathematics. Grade-level standards are set at the 50th percentile at each grade.

Source: New York City Board of Education, Spring 1991
Preliminary Results.

MAT-Mathematics 1989-1991
Percent At or Above Grade Level



• Based on a 1985 national sample.

Source: New York City Board of Education, Spring 1991
 Preliminary Results
Figure 5-2

Students in grade 7 scored well below grade level in 1989 and 1990; however, in 1991 they scored just slightly above grade level. On the other hand, the students in grade 8 scored very much below grade level in all three years.

Table 5-3 (p 153) is a comparison of the grades 2 through 8 MAT-Mathematics test results for 1989, 1990, and 1991. It also shows the net changes between the 1990 and 1991 and the 1989 and 1991 results. As can be seen from the table, the largest increase is for grade 5 from 1990 to 1991. This increase of 15 percentage points is remarkable since it is double that of the next highest increase of 7.7 percentage points for grade 6 over the same period. The greatest increase for the period 1989 to 1991 was 9.4 percentage points for grade 7.

One sees, however, that in grade 5 there was a decrease between 1989 and 1990 of 9.2 percentage points, and an increase of 15.1 percentage points between 1990 and 1991, leaving a net increase between 1989 and 1991 of 5.9 percentage points. Small changes were observed with regards to grades 6, 7, and, 8 during the period, and this was in keeping with the trend in the middle grades. What was most noticeable, however, was that the increases between 1989 and 1990 in these grades were all less than the increases from 1990 to 1991. Nevertheless, an analysis of the data seems to indicate that the new policies implemented by Mr. Fernandez were having some small effect.

In another effort to improve mathematics education the New York City Board of Education tried to set instructional guidelines for the teaching of mathematics in the middle schools in the city through its various *Mathematics-Scope and Sequence* publications. As a result, the *Draft-1988 Mathematics Scope and Sequence* Grade 6 was published in 1988, followed by Grade 7 in 1989, and Grade 8 in 1990. The Grade 6 Scope and Sequence was developed through 72 units, with each unit being represented by a module and a title. Each

module had a suggested period of duration. According to the Introduction to the Scope and Sequence the suggested period was included as a guideline to the teacher for planning purposes as well as for student mastery.³⁵

The Executive Director (Acting) of the Division of Curriculum and Instruction in 1988, Pearl Warner, said that the Scope and Sequence reflected the changes necessary to meet the challenges of the present and the future. Her view was that because the nation was moving from an industrial to an information society, some areas of mathematics that were given little treatment in the past had then become critical. As a result greater emphasis was being placed on such topics as probability, statistics, graphic representation of data, and problem exploration.³⁶

The Grade 6 publication and its counterparts, grade 7 and grade 8, were all part of the continuous process by the New York City Board of Education in its efforts to obtain the ideal middle school mathematics curriculum. It recognized for example, that in the age of technology clearly consumer mathematics would be completely irrelevant, but that advanced algebra would be absolutely necessary. Hence, it was imperative that the elementary and middle school mathematics curricula should be designed to reflect the changes that were occurring in high school and beyond.

The curriculum planners recognized that an important consideration to keep in mind when developing a curriculum would be the needs of all the students for whom it was being designed. They therefore ensured that the situation of special needs students was given prime consideration. As a result the Scope and Sequence project was a joint effort by the regular and

35. New York City Board of Education, Introduction to Mathematics Scope and Sequence Grade 8, New York City Board of Education 1990.

36. Warner, Foreword to the Draft 1988 Mathematics Scope and Sequence Grade 6, 1988.

special education teachers. Also involved in this project were supervisors of elementary and intermediate schools from 16 Community School Districts and some high school teachers and supervisors. Further, some additional suggestions for addressing students with special needs were provided by Lawrence Becker, the Acting Chief Administrator in the Division of Special Education.³⁷

The grade 7 Scope and Sequence had 70 units, while the grade 8 Scope and Sequence contained 89 units. Each Scope and Sequence had a suggested period of duration which was included as a guideline to teachers for planning purposes. The Scope and Sequence was developed cyclically, which meant that information about a topic was not presented all at once but instead was spread throughout the year. According to the introduction to the grade 8 Scope and Sequence, “This approach allowed students to reflect, practice, and build, a firm understanding of an idea at one level before trying to extend it, and also provided an opportunity for them to see the ways the topic is connected to many other topics more clearly.”³⁸

The intention of each Scope and Sequence was to guide teachers through the curriculum by having them use the lesson plans that were already prepared.³⁹ By having lesson plans prepared for teachers the Board was able to maintain uniformity throughout the system. Of course that could happen only if teachers used these lesson plans. There is the probability, however, that this was not always done. Historical evidence and teacher lore indicate that there is very often a difference between the official curriculum and the implemented curriculum. If the lesson plans in the Scope and Sequence were used as specified, the expectation was that there

37. New York City Board of Education, Introduction to Mathematics Scope and Sequence Grade 6, 1988

38. New York City Board of Education, Introduction to Mathematics Scope and Sequence Grade 8, 1990

39. New York City Board of Education, Introduction to Mathematics Scope and Sequence, Grade 6, New York City Board of Education, 1988

would be some uniformity in mathematics classrooms throughout New York City. A sample Grade 6 lesson plan is shown in Figure 5-3 (p159).

The lesson plan is part of a unit that requires two lessons to be completed. It deals with the “Multiplication of 4-Digit Numbers by 3-Digit Numbers.” It is obvious that much of the lesson time was to be spent on drill and practice of the multiplication of a 4 digit number by a 3-digit number. Apart from the problems shown in the lesson plan, it was intended that many more word problems should be taken from the students’ textbooks. It is surprising that the use of the calculator was not mentioned in this lesson, since its use was being highly recommended at that time by NCTM and other influential members of the mathematics education community. Of greater importance though, was the fact that problem solving was given only a very little attention. The section of the lesson, “6.04.01.04A—create and solve word problems related to skills learned in this module,” is the only attempt at problem solving in this lesson. Further, it is questionable whether this could in fact be considered problem solving, since this problem is much below the level of what is suggested by NCTM as problem solving for grades 6-8.⁴⁰

40 .NCTM, *Principles and Standards*, 2000, 256

6.04.01 MULTIPLICATION OF 4-DIGIT NUMBERSBY 3-DIGIT NUMBERS

(2 lessons)

PERFORMANCE OBJECTIVES

The student will be able to...

- *6.04.01.01A multiply multiples of 1000 by multiples of 100;
e.g.,

$$\begin{array}{r} 5\ 000 \\ \times 100 \\ \hline 500,000 \end{array} \qquad \begin{array}{r} 4\ 000 \\ \times 200 \\ \hline 800,000 \end{array}$$

- 6.04.01.02A estimate products by rounding factors to the
left-most place;

e.g.,

$$\begin{array}{r} 2\ 234 \text{ rounds to } 2\ 000 \\ \times 281 \text{ rounds to } 300 \\ \hline 600,000 \text{ is the estimated} \\ \text{product} \end{array}$$

- 6.04.01.03A multiply a 4-digit number by a 3-digit number;

e.g.,

$$\begin{array}{r} 2\ 234 \\ \times 281 \\ \hline 2\ 234 \\ 178\ 720 \\ 446\ 800 \\ \hline 627,754 \end{array}$$

- 6.04.01.04A create and solve word problems related to skills
learned in this module.

e.g.,

A store owner purchased 325 jackets that
cost \$19.95 each. What was the total cost
for these jackets?

Source: New York City Board of Education, Draft 1988 Mathematics
Scope and Sequence, Grade 6

Figure 5-3

It must be noted that at the time when these lesson plans were being written New York City was in the early stages of developing its mathematics standards based on the guidelines laid down by NCTM. Hence, although efforts were made to introduce some of the new standards into the curriculum, parts of the traditional curriculum (which was used in the “back to basics” period) were still reflected in these lessons. The grade 6, 7, and 8 Scope and Sequence which contained the lesson plans were prepared in 1988, 1989, and 1990 respectively; while the Commission on Minimum Standards was appointed by Chancellor Quinones in January 1986, and the Chancellor’s Working Group on Mathematics was appointed in December 1989 and reported to Chancellor Fernandez in June 1990. The standards groups operated during the same time period with the Scope and Sequence development group, but they appeared to have had little or no apparent impact on each other. The groups who were developing standards and those who were working on the Scope and Sequence were working simultaneously; but perhaps they were doing so independently, since the new curriculum was still very traditional.

During this time it was felt throughout the nation that the mathematics curriculum needed reform; and at this time, when New York City was stressing the need to better prepare students to meet an “increasingly information—and technology—based economy,” grades 6, 7, and 8 lesson plans that were prepared for use by New York City teachers unfortunately stressed some aspects of traditional mathematics.⁴¹ This state of affairs clearly shows how difficult it was to change the curriculum. It is safe to say that the reform of middle school mathematics education in New York City during the period was evolutionary rather than revolutionary, as the speed with which it

41. New York City Board of Education, Division of Public Affairs, 1990, New York City Municipal Archives, Series 345, Box 11, Folder, 117.

moved was sometimes painfully slow. Perhaps the argument could be made that the slow pace of reform was quite appropriate, since anything new must be thoroughly considered and understood before it is accepted. The fact is that reform in education, and mathematics education reform in particular, has always been approached in an extremely conservative pace.

The slow march to reform in middle school mathematics education in New York City continued into the twenty first century. For more than sixty years the New York City Board of Education had been trying to develop that ideal middle school mathematics curriculum which had proved to be quite illusive. Since May 14, 1940, when the Board of Education adopted the *Course of Study in Mathematics-Elementary and Junior High Schools*, those who prepared the Course of Study asserted that “the chief utilitarian purpose of teaching mathematics is the development of an ability to solve problems in life situations.”⁴² To them a mathematics curriculum designed to equip students to engage in problem solving would be ideal. Sixty-one years later in July, 2001, the *Instructional Guide Mathematics Grades 6-8*, echoed similar sentiments when it claimed that the characteristics of a standards-based classroom are, among other things, to challenge students with intellectually and academically rigorous instruction, and to give students opportunities to engage in tasks that are experiential and authentic in meaningful contexts.⁴³

The 2001 instructional Guide suggested that the best method of teaching mathematics was one in which there was a balance in the understanding of concepts, proficiency in basic facts, and problem solving strategies. The guide further recommended the use of a workshop

42. New York City Board of Education, *Course of Study in Mathematics*, New York City Board of Education, 1940

43. New York City Board of Education *Instructional Guide: Mathematics, Grades 6-8*, 2001

model of instruction, claiming that this model helped to develop the necessary mathematical communication that was needed to create proper understanding of mathematics.⁴⁴ According to the Guide, instruction in mathematics should be driven by New York State and the New York City Standards. In addition, it further identified, in detail, the characteristics of a standards-based classroom.⁴⁵

Perhaps because of all the concern with standards, for the first two years of the 1990s the city school system witnessed improvements in the mathematics test scores. However, an unfortunate decline of more than ten percentage points in the mathematics scores followed the introduction of the new California Achievement Test. This new test, introduced in 1993, replaced the MAT-Math test, which had been administered since 1986. In 1992, about 60 percent of New York City grades 2 through 8 mathematics students scored at or above grade level, compared to just 48.4 percent in 1993. The chancellor's office gave as a reason for the decline the fact that there was a concentration of high poverty in New York City and that, coupled with a huge number of immigrant students who spoke little or no English, and the limited availability of resources, presented a great challenge to the city's education system.⁴⁶ Since the problems mentioned had been affecting the city long before this, these excuses were quite unpersuasive.

It is common knowledge that students tend to perform poorly on a test when it is first administered.⁴⁷ However, test scores gradually rise as teachers and students become more

44. The Workshop Model is a highly prescribed format of instruction. The main components are the mini lesson which should be no longer than 10-15 minutes long; the group activity this is the heart of the model and it is when the students actually work in small groups for about 20-25 minutes; the final part is the share where the students discuss their work and explain their thinking for about 5 minutes.

45. New York City Board of Education Instructional Guide: Mathematics, Grades 6-8, 2001

46. Dillon, New York City Sees Decline In Math Scores, *New York Times*, June 9, 1993

47. Dillon, New York City Sees Decline In Math Scores, *New York Times*, June 9, 1993

familiar with it.⁴⁸ This was observed in 1986 when the MAT-Math was first administered. In that year 51.1 percent of the grades 2 through 8 mathematics students scored at or above grade level. This was a decline of 9.1 percentage points from the previous year's score of 60.2 percent. The decline in scores should not have come as a surprise to officials in the New York City education system since the new test was designed to be more difficult. It was also seen as a better measure of analytical skills as it was based on the NCTM standards. This new test was scored against a national average determined in 1991, while the test used previously, MAT-Math, was normed in 1985. As a result of the new test it was now easier to assess the standing of New York City students relative to students in the rest of the country.

The new test was subject to criticism because of the decline in the scores of the students. However, there were a few people who stood up to defend the new test against those who were comparing the performance of the students on the new test with that of the previous one. One such person was the Executive Director of New York City Public Schools, Robin Willner; in a letter to the *New York Times* she attempted to clear the air regarding the decline of the mathematics scores in 1993. According to her a new test was warranted because it was inaccurate to compare the percent of students scoring at or above a 1985 definition of grade level to the percent of students scoring at or above a 1991 definition of grade level.⁴⁹ The new test provided comparisons to what was then a current national average, while the previous test provided comparison to a national average that was determined eight years before.

48. Dillon, New York City Sees Decline In Math Scores, *New York Times*, June 9, 1993

49 Robin Willner, letter to the editor, *New York Times*, June 21, 1993

Table 5-4
Citywide Mathematics Test Results
1993-1998
Grades 3 through 8

Year	Percent of Students at or Above grade level	Increase (percentage points)
1993	48.4	
1994	49.9	1.5
1995	53.3	3.4
1996	58.5	5.2
1997	60.4	1.9
1998	63.1	2.7

Source: New York City Board of Education, Citywide Mathematics Test Results, 1993-1998

In 1994 the citywide test score increased by 1.5 percentage points over that of 1993 (Table 5-4 p164), and while he was pleased with these results, the new Chancellor Ramon Cortines, was unhappy with the achievement gap identified by the data. It was the first year that the mathematics test results were broken down by ethnicity, and, as a result, the flaws in the system became quite obvious. He thought that the glaring disparities between groups of students highlighted the system's shortcomings. He felt that there was a need to strengthen the curriculum and improve instructional material and teacher training. In addition, he also felt that a special effort should be placed on the middle school because of its consistently falling scores.⁵⁰

50 Jones, Test Scores Show Gaps By Ethnicity, *New York Times*, July 8, 1994

Over the years each new chancellor felt that the first test scores during his term in office were the best. Thus the 1997 scores were hailed as a significant achievement by Chancellor Rudy Crew, who took office in 1996. The new chancellor said that the results demonstrated that a focus on high standards, appropriate and challenging assessments, and strong professional development yielded improved student achievement. The chancellor's elation was, however, countered by a board member, Carol Gresser, who considered the results to be only a "modest increase."⁵¹ Board member Gresser was quite correct because the increase in 1995 was 3.4 percentage points; the increase in 1996 was 5.2 percentage points, while the increase in 1997 was only 1.9 percentage points. When these facts are considered it appears that the chancellor's claim that the achievement was "significant" was in fact somewhat overstated.

The weak performance by the students in the middle grades caused serious concern to the State Education Department. The State Commissioner, Richard Mills, was very unhappy with the number of students failing the High School Regents mathematics examinations, and he believed that the low scores in the middle grades and the high failure rate at the Regents examination were definitely linked. To counter this trend the state introduced a new eighth grade standardized mathematics test in 1999. This test was to be administered to eighth grade students throughout the state. It was a much tougher test than the previous one and included topics in mathematics like algebra and trigonometry, which had been previously introduced in high school.

The benefits of a state standardized test were supposed to be three-fold. First, the results of the test were to be used by the State Education Department to rank schools and school districts

⁵¹ Somini Sengupta, Student Math Scores' Gain Is The Smallest In Recent Years, *New York Times*, June 24, 1997

throughout the state. In this way the state would be able to prepare a list of failing schools so they could be reorganized and offered assistance in order to facilitate them to become successful. The second benefit was that the results of the state test could be compared to those of the National Assessment of Educational Progress (NAEP), which was supported by the United States Department of Education. A lack of correlation of the trends for the New York students on the state and national tests would have indicated that there was some irregularity in the testing. The third benefit was to parents, who sometimes used these results to decide to what school to send their children, or in which district they should live.⁵²

The table below (Table 5-5, p167) is a comparison of the percent of grades 3 through 8 students who scored at or above grade level on the citywide mathematics test in the years, 1999-2002. As can be seen from the table, there was some decline of the scores in the middle grades but it was not as pronounced as it was previously. However the scores were still unsatisfactory and this was a problem that had defied the best efforts of successive chancellors to find a solution. The unsatisfactory mathematics scores and the sharp decline as the students enter the middle grades, had perplexed mathematics educators and officials in New York City for a very long time.

The unsatisfactory mathematics scores was a major concern to the State Education Department also, particularly the performance of the students in the eighth grade who needed to be ready for the Regents examination in four years to be able to graduate from high school. Richard Mills, the State Commissioner of Education, stated that most of the public discussion

⁵² Hartocollis, Stiffer Standards for 4th and 8th Grades, *New York Times*, February 11, 1998.

had been about the Regents examination. This was so because they felt that it was more difficult than the previous one. But examinations were needed at the elementary and middle grade levels to prepare

**Table 5-5
Mathematics Test Results
Percent of Students at or above Grade level**

<i>Grades</i>	<i>1999</i>	<i>2000</i>	<i>2001</i>	<i>2002</i>
<i>3</i>	<i>41.7</i>	<i>38.7</i>	<i>40.6</i>	<i>47.2</i>
<i>4</i>	<i>49.6</i>	<i>46.2</i>	<i>51.8</i>	<i>52.0</i>
<i>5</i>	<i>31.4</i>	<i>37.2</i>	<i>29.0</i>	<i>32.2</i>
<i>6</i>	<i>26.6</i>	<i>26.5</i>	<i>31.9</i>	<i>34.9</i>
<i>7</i>	<i>26.1</i>	<i>27.7</i>	<i>24.5</i>	<i>26.3</i>
<i>8</i>	<i>22.8</i>	<i>22.3</i>	<i>22.8</i>	<i>29.8</i>
<i>Citywide</i>	<i>33.7</i>	<i>33.7</i>	<i>34.0</i>	<i>37.3</i>
<i>Number of</i>				
<i>Students Tested</i>	<i>424,665</i>	<i>454,578</i>	<i>459,830</i>	<i>464,116</i>

Grades 3 through 8, 1999-2002

Source: New York City Department of Education

students for the Regents examinations.⁵³ The public was concerned about the new Regents requirements because they had replaced the less stringent Regents Competency Test (RCT), which had been the previous requirement for high school graduation.

From Table 5-5 it becomes clear that the citywide score increased by 3.6 percentage points from 1999 to 2002. While there had been an overall increase citywide, in each year the

53. Hartocollis, Stiffer Standards for 4th and 8th Grades, *New York Times*, February 11, 1998

percent of students in grades 6, 7, and 8 scoring at or above grade level was lower than the percent of students scoring at or above grade level in each of the elementary grades. In 1999, 31.4 percent of the students in grade 5 scored at or above grade level. In that same year 26.6 percent of students in grade 6 scored at or above grade level; 26.1 percent of students in grade 7 scored at or above grade level; and only 22.8 percent scored at or above grade level in grade 8. A similar trend can be observed in the year 2000, where grade 5 was 37.2 percent; grade 6 was 26.5 percent; grade 7 was 27.7 percent; and grade 8 was 22.3 percent. It is important to note that the drop-off in scores started in the earlier grades. This needs to be carefully monitored as it could possibly be a new trend developing.

Towards the end of the period the gap between the 6th grade and the 7th grade students tended to narrow somewhat. (Table 5-6, p168) In 1999 the 7th grade score decreased by 0.5 percentage points; in 2000 it increased by 1.5 percentage points; in 2001 it decreased by 7.4 percentage points; and in 2002 there was a decrease of 12.4 percentage points. As can be seen, in 1999 the gap appeared to be closing; however from 2000 the gap started to widen again.

Table 5-6
Comparison of Changes in Mathematics Scores Between
6th and 7th Grades in 1999 through 2002

Year	percentage points	Change
1999	0.5	down
2000	1.5	up
2001	7.4	down
2002	12.4	down

Thus, even though the problem seemed to be solved in 1999 and 2000, the trend in the succeeding two years clearly indicated that this was not so.

Mayor Michael Bloomberg and his newly appointed Schools Chancellor, Joel Klein, were both very encouraged by the 2002 state test results. This was their first test and the fact that the scores of the eighth grade students had improved by 7 percentage points over the previous year gave them hope that much more could be done. Robert Berne, Senior Vice President at New York University, believed that some credit should be given to the previous chancellor, Harold Levy, who had put a lot of emphasis on mathematics in the schools.⁵⁴ Mr. Berne suggested that this had helped to bring about the improvement on the state test that was witnessed by Mayor Bloomberg and Chancellor Klein. The fact is that after he took over from Chancellor Rudy Crew, Chancellor Levy did place great emphasis on mathematics teaching and learning; and it is quite possible that this emphasis may have been partly responsible for the improvement in the scores. This supposition was further substantiated by principals and district superintendents who said that the improvement could be attributed to more intense drilling, longer school days, and better cooperation between parents and schools.⁵⁵

Notwithstanding the improved scores, the fact that 70 percent of New York City eighth grade students failed to meet the state standards was still very troubling to mathematics educators in the city. Close examination of the 2002 results shows that 33 percent of the students scored at level I, (see Table 5-7, p170) the lowest level on the state test. This is far below what New York State Education Department expected of its students; however it is a far better performance than

54. Zhao, 8th Grade Math Test Scores Rise, *New York Times*, September 14, 2002

55. Zhao, Fourth Grade State Math Test Results, *New York Times*, September 15, 2002

in 1999, when a disappointing 48 percent of New York City eighth graders scored at Level 1. This meant that in 1999 nearly half of New York City eighth grade students were unable to do any mathematics beyond elementary arithmetic.⁵⁶

56. Paul H.B. Shin and Alison Gendar, Math Test Disaster 77% Flunk New 8th Grade State Exam, *Daily News*, November 6, 1999.

Table 5-7
Percentage of Students at various Grade Levels in Mathematics Grades
6, 7, and 8, 1999—2002

Grade	1999				2000				2001				2002			
	Level				Level				Level				Level			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
6	35.3 %	38.1 %	17.5 %	9.1 %	34.5 %	39.0 %	19.2 %	7.3 %	33.0 %	35.1 %	21.0 %	10.9 %	27.2 %	37.9 %	20.3 %	14.6 %
7	39.3 %	34.6 %	19.6 %	6.5 %	37.7 %	34.6 %	20.3 %	7.4 %	45.3 %	30.3 %	18.2 %	6.2 %	40.5 %	33.2 %	17.7 %	8.7 %
8	47.8 %	29.5 %	18.6 %	4.1 %	44.3 %	33.5 %	19.2 %	3.4 %	44.2 %	33.0 %	18.0 %	4.7 %	33.2 %	37.1 %	23.7 %	6.1 %

Source: New York City Board of Education, 2002.

From Table 5-7 it can be seen that there was a steady improvement in student performance over the period. The number of students at level 1 gradually decreased from 47.8% in 1999 to 33.2% in 2002. In the meantime, the number of students in level 4 increased from 4.1% in 1999 to 6.1% in 2002. Hence, Mayor Bloomberg and Chancellor Klein had every reason to be pleased with the 2002 results, since the outlook was definitely positive.

Debate on the New Curriculum

While the mayor and the schools chancellor were happy with the 2002 mathematics test results, many parents and mathematicians were not happy with the curriculum. The cause of the unhappiness was the fashioning of the mathematics curriculum on the guidelines laid down by the NCTM. The *Curriculum and Evaluation Standards for School Mathematics*, published by the NCTM in 1989, and its updated version, *Principles and Standards for School Mathematics*,

published in 2000, although highly acclaimed by many, met with very strong opposition from some parents, teachers, and mathematicians.

The major opposition to the reform curricula came from two main sources. The first was NYC HOLD (for Honest Open Logical Debate on Mathematics Education Reform), a consortium of parents, educators, mathematicians, and scientists. It was founded in January 2000 by a group of Manhattan parents and NYU mathematicians. The organization was first established in order to support the objections of parents, teachers and mathematicians to the mathematics curricula that were based on NCTM Standards and introduced in New York City schools.

The group was formed in New York City's District 2 because it was one of the first districts to have implemented the new reform curricula that were mandated by the Board of Education. The mathematicians in the group examined the new mandated programs and then advised, "We have examined closely new curricula that have been implemented in New York City and nationwide, and believe firmly that K-12 students subjected to these curricula, including *TERC Investigations*, *Connected Mathematics Project (CMP)*, *Interactive Mathematics Program (IMP)*, and *Mathematics, Modeling our World (MMOW/ARISE)*, will have little if any chance to succeed in even basic mathematics and science courses when they get to college."⁵⁷ They also strongly criticized the *Everyday Mathematics* program which was also newly mandated in New York City K-5.

The program, *TERC: Investigations in Number, Data, and Space*, was probably the most prominent of the reform mathematics curricula for K-5 before it was replaced by *Everyday Math*.

57. NYC Hold National: *Who We Are*, <http://nychold.org/who-we.html>

The TERC program did not come with traditional student textbooks and workbooks. Instead, each year of the curriculum was sold as a box full of material: teacher guides for the year and for individual units, posters, overhead transparencies, manipulatives, work sheets, and assorted gadgets.⁵⁸

The *Connected Mathematics Project* (CMP) curriculum was sponsored by the National Science Foundation and developed for grades 6-8. The reviewers of this program believed that, overall, it seemed to be incomplete, and they thought that it was aimed at underachieving students rather than normal or higher achieving students. According to them, that in itself was not a problem unless, as was the case, the program was advertised as being designed for all students.⁵⁹

Another middle school reform program which was introduced in New York City schools was *Mathematics in Context* (MIC). This was a project of the University of Wisconsin—Madison and the Freudenthal Institute at the University of Utrecht, Netherlands. The aim was to create a comprehensive mathematics curriculum for the middle grades that reflected the content and pedagogy suggested by the NCTM Standards⁶⁰

The above program received a positive review when a multi-year study was done in four states by Holt, Rinehart and Winston in grades 6-8 schools who used it. The study was started in 1999 and included four schools in Brooklyn, New York: Walt Whitman MS248; Charles O. Dewey MS136, Mahalia Jackson MS391; and Meyer Levin IS285. The number of students

58. NYC HOLD *Review of TERC: Investigations in Number, Data, and Space*, <http://nychold.org/terc.html>

59. R. James Milgram, *An Evaluation of CMP*, <ftp://math.stanford.edu/pub/papers/milgram/report-on-cmp.html>

60. *Mathematics in Context*, <http://www2.edc.org/mcc/PDF/perspmathincontext.pdf>

participating in the study was 3176, 98% of whom were minority.⁶¹ According to the study the schools showed dramatic improvements in their 8th grade scores. Table 5-8 shows the results of the study.

Table 5-8
Results of Study of Schools in Brooklyn Using Mathematics in Context
1999-2002

Schools	1999		2000		2001		2002	
	Levels		Levels		Levels		Levels	
	1 & 2	3 & 4	1 & 2	3 & 4	1 & 2	3 & 4	1 & 2	3 & 4
MS246 Walt Whitman	63.7%	8.3%	66.2%	6.8%	61.3%	7.1%	50.7%	11.1%
MS136 Charles Dewey	75.7%	3.9%	69.7%	4.1%	57.1%	12.9%	43.4%	20.9%
MS391 Mahalia Jackson	xxx	xxx	82.5%	0.3%	75.3%	1.8%	56%	5.8%
IS285 Meyer Levin	46.4%	18.6%	32.9%	23.4%	44.9%	13.5%	29.9%	22.5%

Source: Holt, Rinehart and Winston,

http://www.middletowncityschools.com/administration/departments/math/educators/middle/pdf/mic_research.pdf

One school, MS136, made an impressive gain of 17 percentage points during the period. The other three schools showed some modest improvement during the period. MS246 improved by 2.8 percentage points; MS391 started to use the program in 2000 and showed an improvement

61. Holt, Rinehart and Winston, *A Longitudinal Study Of The Instructional Effectiveness Of Mathematics In Context*, March 2005.

http://www.middletowncityschools.com/administration/departments/math/educators/middle/pdf/mic_research.pdf

of 5.3 percentage points; and MS285 improved by 2.9 percentage points. The study was an attempt to counter the arguments of the critics by showing that a curriculum based on standards was meeting the needs of the students.⁶²

The third program mentioned above, the *Interactive Mathematics Program* (IMP), was a High School mathematics curriculum developed since 1989 and designed to exemplify the NCTM Standards. According to the review the IMP preparers claimed that the curriculum integrated traditional material with additional topics recommended by the NCTM Standards, such as statistics, probability, curve fitting, and matrix algebra.⁶³ Another high school mathematics program, *Mathematics, Modeling our World* (MMOW/ARISE), which was an integrated core curriculum for high schools that was based on the premise that students learn best when they are actively involved in the process, was also implemented in the schools during the period.⁶⁴

NYC HOLD appeared to be supportive of mathematics education reform, but the group was strongly opposed to the new direction in which the authorities were taking the mathematics curriculum. They claimed that NCTM officials had propagated ten myths in support of their argument. They considered the first myth propagated by NCTM and its supporters to be that “only what students discover themselves is truly learned.” According to NYC HOLD the reality is that students learn in a variety of ways and discovery learning is only one of them. They

62. It must be borne in mind that this study was carried out by Holt, Rinehart and Winston, who was the exclusive distributor of the program

63. NYC HOLD, *Reviews of IMP: Interactive Mathematics Program*, <http://nychold.org/imp.html>

64. ARISE is an acronym for Applications/Reform in Secondary Education.

claimed that successful mathematics programs use discovery for only a few carefully selected topics, never all topics.⁶⁵

The second source of opposition to the new curricula was *Mathematically Correct*, a website that was devoted to the concerns raised by parents and scientists about “the invasion of our schools by the “new-new math”” and “the need to restore basic skills to math education.”⁶⁶ The website was created in 1997 and, although it was national in scope, it focused mainly on advocating against the mathematics curricula in California. Apart from its focus on California, it also served as a national forum for all who were opposed to curricula that were based on NCTM standards. Members of the New York group, NYC HOLD, made use of the opportunity offered by the *Mathematically Correct* forum to explain their position nationally.

Supporting the reform of mathematics education was the group, *Mathematically Sane*, which used its website to disseminate information on the benefits of reform curricula. The group was in opposition to the views of NYC HOLD and *Mathematically Correct* and offered counter-arguments to their criticisms of the programs that were based on the NCTM standards.

The group stated that there were at least two sides to every issue, including the so-called “Math Wars.” It felt that for too long the public had heard primarily from the side of the traditionalists; for too long the case for reform had been unfairly characterized as “Fuzzy Math” ; and for too long there had been an insidious campaign to return mathematics instruction to the failed practices of the past. Therefore, the *Mathematically Sane* website was developed to

65. Budd, NYCHOLD, Ten Myths About Math Education, May 4, 2005, 1

66. *Mathematically Correct*, <http://www.mathematicallycorrect.com/>

provide a broad array of evidence to show that reform initiatives had been successful and had raised student achievement in school districts across the country.⁶⁷

There were many items of disagreement between the two sides. For example, they disagreed on whether or not traditional long division should be included in the curriculum. A word problem will serve to illustrate this. “A book with 1344 pages is borrowed from a library. It is due in 21 days. How many pages of the book must be read each day by the borrower so that it could be returned on time?” The supporters of the traditional curriculum argued that children should be taught to solve such a problem by using the long division algorithm as shown in the example below.

$$\begin{array}{r} \underline{64} \\ 21 \overline{)1344} \\ \underline{-126} \\ 84 \\ \underline{-84} \\ 0 \end{array}$$

On the other hand reformers argued that such a procedure was time consuming and unnecessary in the age of the calculator. They contended that it was easier to estimate the answer by rounding 21 to 20, and rounding 1344 to 1300 and so arriving at an estimate of about 65 pages. This is the method that the reformers wanted students to learn.⁶⁸

The standards reform in mathematics in New York City schools began in the early 1990s. The reform curricula, popularly termed the “new new math,” were reminiscent of the reforms in the early 1960s, which was then known as the “new math.” The controversy surrounding the

67. Mathematically Sane, “Why MathematicallySane.com?” <http://search.aol.com/aol/search?invocationType=webmail-hawaii1-standardaol&query=why%20mathematics%20sane.com%3F%20>

68. Joseph G. Rosenstein, Mathematics Standards, Division, and Constructivism, Mathematically Sane, <http://mathematicallysane.com/analysis/mathstandards.asp>

“new new math” in New York City was really part of the national “math wars” which had started in California a few years earlier. California had experimented with an extremely constructivist mathematics curriculum and this had been met with anger and outrage by mathematicians, teachers, and parents.

The debate about what and how to teach New York City middle school mathematics students has continued into the twenty-first century. Both sides still disagree on what is best for the students. This is not strange since this debate has been going on for over a hundred years. According to David Klein, “There is nothing new about the disagreements over the best ways to educate the nation’s school children. The periodic waves of educational reform from the nation’s colleges of education are more similar than they are different.”⁶⁹ He believes that in some respects the wars of the 1990s have little to distinguish them from those of earlier periods. However, as is always the case, nothing is absolute, and what is best for New York City middle school mathematics students may not be at either end of the continuum but lies somewhere in the middle.

Hence in trying to develop that ideal curriculum another major attempt to set standards in New York City occurred in 1996 when the New York City Board of Education adopted a plan to introduce and implement learning standards in all content areas. According to Judith A. Rizzo, who served as Deputy Chancellor for Instruction under both Chancellor Rudolph Crew and Chancellor Harold Levy, “The Board recognized that the process of becoming a standards-driven system would be a multiyear effort, requiring us to reexamine policies and practices with special emphasis on aligning assessments, redirecting resources, and improving professional

69. Klein, *A Brief History American K-12 Mathematics Education*

development.”⁷⁰ In all of this the Board tried to work closely with the New York State Education Department in order to ensure that the city’s standards and assessments were aligned with those of the state.

As it was developing standards for New York City in the mid-1990s, the Board considered both state and national standards. This was in keeping with the views of former chancellors, who had been mindful of the national standards when creating those for the city. Rizzo claimed that although the Board’s belief that the need to align the city standards with state and national standards was paramount, it also recognized that there was also the need for some local ownership of the standards if they were to be fully accepted. As a result many local participants in the field of education—teachers, principals, and other pedagogical staff—were employed in customizing the standards. The major aim of the customization process was to review the New Standards, the NCTM standards, and the New York State Education Department Learning Standards in order to develop standards which connected with the New York City teachers and students.⁷¹

The drafts of the New York City Standards were compared with national and local curricula of other countries, with textbooks, assessments, and examinations from other countries, and, where possible, with work produced by students in other countries by the Performance Standards development team under the leadership of Dr. Rizzo.⁷² This was an attempt to make

70. Rizzo, *Standards Are Not Enough: Challenge of Urban Education*, 2003, 201.

71. The New Standards is a project that was co-directed by the National Council on Education and the Economy and the Institute for Learning at the University of Pittsburgh. Its mathematics standards reflected those of the NCTM.

72. The New York City Performance Standards Development team was led by the Deputy Chancellor for Instruction Dr. Judith A. Rizzo. The team included the following: Dr, Margaret R. Harrington, William P. Casey, Elsie Chan, Robert J. Kane, Betty D. Burrell, Lawrence Pero, Jonathan Molofsky, Myrna Rodriguez and 10 others.

New York City’s mathematics education standards as rigorous and demanding as they were in other countries. A Consultative Draft of the Standards was subsequently produced and shared with researchers in other countries for review. Some of the countries to which the Draft was submitted were Australia, Canada, England, Sweden, Japan, Singapore, Germany and France.⁷³

Dr. Rizzo also stated that the New York City Mathematics Standards were organized into five groups which reflected NCTM standards.⁷⁴ These New Standards were released in 1998. A comparison of the New York City groups and the NCTM groups as identified by Dr, Rizzo is shown in Table 5-9 below.

**Table 5-9
Comparison of NYC and NCTM Standards**

<u>New York City Performance Standards</u>	<u>National Council of Teachers of Mathematics</u>
Arithmetic and Numeration Concepts	Number and Operations
Geometry and Measurement Concepts	Geometry; Measurement
Function and Algebra Concepts	Algebra
Statistics and Probability Concepts	Data Analysis and Probability
Mathematical Process	Problem Solving; Reasoning and Proof; Communication; Connections
	Representation

73 New York City Board of Education, Introduction to Performance Standards, 1998, 4

74 Rizzo, Standards Are Not Enough: Challenge of Urban Education, 2003, 202

The table of comparison above (Table 5-9) clearly shows how much the New York City groups reflected those of the NCTM. Not only were the groups similar, but the actual New York City standards were closely aligned to the NCTM standards. A good example is the algebra standard. NCTM says that “In grades 6-8 all students should:

- represent, analyze and generalize a variety of patterns with tables, graphs, words, and, when possible symbolic rules
- relate and compare different forms of representation for a relationship
- identify functions as linear or nonlinear and contrast their properties from tables, graphs, or equations.”⁷⁵

This result is also closely reflected in the New York City Middle School Mathematics standards when it declares in its Functions and Algebra concepts that students should (a) discover, describe, and generalize patterns, and represent them with variables and expressions; (b) represent relationships; (c) analyze tables to determine functional relationships; (d) find solutions for unknown quantities in linear equations.⁷⁶ It would seem from what is observed in the comparison that great care was taken to align the New York City standards with the NCTM standards.

New York City has always made efforts to bring its education system up to national standards. Since the mid-1960s, when Deputy Superintendent of Schools, Joseph Loretan, advised that the city must meet “the challenge of the new directions and the awakened interest in

75. NCTM, *Principles and Standards for School Mathematics*, 2000, 222.

76. New York City Board of Education, *Performance Standards*, 1998, 76

mathematics,⁷⁷ there has been a continuing attempt by successive chancellors to raise the standard of mathematics education in the city. The urgent need for improvement was fueled by several problems which had beset the New York City school system. One was the problematic achievement gap which has bedeviled the city throughout the latter half of the twentieth century. Another was the difficulty in meeting the needs of such a diverse body of students who reside in the city. There was, however, one other problem of particular concern to mathematics educators in New York City.

Shortage of Mathematics Teachers

Over the years the New York City school system had developed the practice of hiring large numbers of uncertified teachers to meet its teaching needs, particularly for mathematics in the junior high schools. However, this practice met with disfavor from the New York State Regents, and in 2000 they sued the city⁷⁸ to require certified teachers in every classroom in all failing schools. These failing schools were termed Schools Under Registration Review (SURR). The Regents plan was that all schools with less than 90 percent of their students meeting or exceeding the state performance benchmark would be placed under registration review; however, in actual fact, only those schools with more than sixty percent of their students below standard were considered for inclusion on the SURR list.⁷⁹

77. Loretan, Foreword in *Mathematics Cycles Grade 6*, 1965.

78. *Mills v. Levy*, Supreme Court of the State of New York, Consent Order No. 26190/00 (August 24, 2000)

79. Joseph P. Viteritti and Kevin Kosar, *The Tip of the Iceberg: SURR Schools and Academic Failure in New York City*, Civic Report No. 16, July 2001, 1.

As a result three major programs aimed at alleviating the problem of the shortage of mathematics teachers in New York City were started, two of them prior to (perhaps in anticipation of) the lawsuit and the other just after it. These programs arose because of the desperate position in which the city found itself. For example, in 1999-2000 seventeen percent of New York City Teachers were uncertified or taught in subjects other than those in which they were certified.⁸⁰ The state considered the situation intolerable and demanded stricter adherence to its standards. To further complicate the situation, the federal government was about to enact legislation to have only certified teachers in the classrooms. This new legislation, the No Child Left Behind (NCLB) Bill, demanded stricter standards and appeared to be quite uncompromising.

The first program in the effort to solve the problem was the attempt by New York City to attract mathematics teachers from overseas. This international effort began in 1998 when some members of the City College School of Education were able to encourage twenty five mathematics and science teachers from Austria to come to New York to teach in the city.⁸¹ At the time there was a surplus of mathematics teachers in Austria, and the authorities there were happy that some of them could find employment in the United States. This was not a significant quantity in terms of the total number of teachers needed in the system, but it was a significant addition to the critical shortage areas of mathematics and science.

The second was the Teacher Opportunity Program (TOP) which was conducted by the City University of New York. In this program, individuals who had majored in mathematics but

80. Court of Appeals, State of New York Campaign for Fiscal Equity Inc., et al. Appellant-Respondents, against The State of New York, et al., Respondents-Appellants, August 2006

81. Posamentier and Coppin, How the Nation's Largest City Is Managing One of Its Severest Math Teacher Shortages, 2005, 582

had not completed any education courses were offered a free masters degree. This degree program prepared them for certification by the New York State Education Department and qualified them to teach in the city. The TOP program represented a collaborative initiative between The City University of New York and the New York City Department of Education. While it was not an extensive program it did add some new mathematics teachers to the school system.

The TOP program also provided the following benefits to highly qualified baccalaureate program graduates seeking to pursue a career in teaching: stipends, education awards, and mentorship. The participants had to commit to teaching in New York City for two years following completion of their master's degrees. These scholars received a full tuition waiver from the University for the graduate courses that were required for the master's degree that led to permanent certification in a targeted teacher shortage area. Participating colleges included Brooklyn, City, Hunter, Lehman, Queens, and the College of Staten Island. For the first year, the program focused on mathematics and science, including biology, chemistry, and earth science, or geology, or physics.

The third program, the New York City Teaching Fellows (NYCTF), was started in August 2000 as a result of the acute shortage of teachers in general and mathematics teachers in particular. The situation was made worse by the court order resulting from the successful lawsuit of the New York State Education Department. The court order translated into a need for 12000 newly certified teachers by September, 2001.⁸² Faced with such a daunting prospect the New

82. Michelli, *The Politics of Teacher Education: Lessons From New York City*, *Journal of Teacher Education*, 56 (2005): 237.

York City Board of Education was compelled to find new and innovative ways of attracting certified teachers. Thus the NYCTF was designed to offer career changers an opportunity to teach in the city. The NYCTF package was quite attractive as it offered participants a summer stipend, a fully paid master's degree, and a guaranteed job.⁸³ By September 2002 this program had brought about 3500 teachers into the city schools. Notwithstanding all this effort by the Board of Education, however, the junior high schools were still hard pressed to find sufficient certified mathematics teachers.

Some assistance did come in May 2002 when both the United Federation of Teachers and the Board of Education agreed that teachers' salaries in the city were uncompetitive and they settled on, among other things, a 22 percent increase in the starting salary for new teachers, raising it from \$31,910 to \$39,000. The increases in teachers' salaries virtually eliminated the hiring of uncertified teachers. The New York City school system was flooded with applications from people who now wanted to teach in the city. More than 8000 qualified teachers came into the system. As a result of this the Board was able to fill 90 percent of the teacher vacancies with certified teachers compared to 50 percent in prior years.⁸⁴

Even though there was a flood of applicants for teaching positions in New York City there were still not enough in the areas that were always in short supply-- mathematics, science, and special education. The salary increase appeared to be insufficient to attract enough of these

83. Michelli, *The Politics of Teacher Education: Lessons From New York City*, *Journal of Teacher Education*, 2005, 56; 238.

84. *Court of Appeals, State of New York Campaign for Fiscal Equity Inc., et al. Appellant-Respondents, against The State of New York, et al., Respondents-Appellants*, August 2006; *Goodnough Shortage Ends as City Lures New Teachers* *New York Times*, August 23, 2002.

teachers. It is significant, however, that in the salary negotiations between the UFT and the Board the issue of salary differential suggested earlier for mathematics teachers was not raised.

At the beginning of the twenty-first century New York City had still been unable to attract sufficient mathematics teachers for its middle schools. This problem persisted for various reasons. One of these reasons was the fact that many college students majoring in mathematics do not aspire to be mathematics teachers because they know they can make more money in mathematics related jobs in industry.⁸⁵ This has been mentioned earlier and is only repeated here to make the point that although many researchers have come to that conclusion yet the authorities are unable or unwilling to address the situation.

Summary

Two chancellors in the 1980s appointed commissions to look into the question of setting standards for the New York City school system. They both made recommendations for new standards for the city school system; nevertheless the curricula in the late 1980s and throughout most of the 1990s still contained much of the traditional mathematics. Besieged on one side by the reformers and the supporters of NCTM, and on the other by the traditionalists who fought to have the curriculum focus on the basics, the curriculum development division of the New York City Board of Education appeared to find itself on the horns of a dilemma.

By the late 1990s, however, the reformers appeared to have won the battle with the introduction of new standards-based curricula in the schools of New York City. The apparent victory brought into existence such organizations as NYC HOLD and Mathematically Correct,

85. Posamentier and Coppin, How the Nation's Largest City is Managing One of its Severest Math Teacher Shortage, *Mathematics Teacher*, Vol. 98, No. 9, May 2005

both of whom were devoted to bringing about the demise of the standards curriculum. These groups were very critical of some highly constructivist programs that were mandated for New York City middle schools. One such program, Mathematics in Context, met the ire of critics as it was based on the philosophy that children should develop their own knowledge and that the teacher should only be the guide on the side. However, the results of a multi-year study done by the distributors of the program seemed to indicate that mathematics scores rose in schools that used the program.

With all the debate surrounding the content of the curriculum the major crisis—the weakness of middle grade students in mathematics—seems to have been forgotten, or at least pushed aside. Perhaps it was believed that reform of the curriculum was a panacea for all the ills which affected mathematics students in New York City. The loyalty to opposing philosophical camps wreaked havoc with the city's middle school mathematics curriculum, moving it from traditional and basic in the 1970s to highly constructivist in the late 1990s. The debate about content versus algorithm continued and still the students in grades 6 through 8 continued to fall below the required standard.

Contributing to the failure of New York City middle school students in mathematics was the high percentage of uncertified teachers in the schools. In 2001 New York City had 80,000 public school teachers, 16% or 12,800 of whom were uncertified.⁸⁶ This was a problem which had plagued the city school system for a very long time. Various efforts by city's education authorities to solve the problem met with partial success. While qualified teachers were brought into the schools, there were still not enough teachers in the major shortage areas, mathematics

86. Goodnough, Shortage Ends As City Lures New Teachers, *New York Times*, August 2, 2002

and science. The period 1986-2002 ended as it had begun, with failing middle grade students and teacher shortages in critical content areas. That was the situation in 2002.

CHAPTER SIX

CONCLUSION AND FINDINGS

This study could be considered to be a prologue as it ends at the beginning of the NCLB. The effects of this major piece of legislation will not be realized for some time. It would be premature, therefore, to make any predictions regarding its effectiveness. Nevertheless, its supporters seem to have immense confidence in its ability to transform the nation's education. Locally, in New York City, questions about the Bloomberg/Klein school administration remain to be answered as their administration too began as this history ended.¹ What will be their legacy? Only time will tell. The continuing story must be told.

The purpose of this study was to analyze the issues which drove New York City's mathematics education policy during the period 1958 to 2002. In this regard several significant aspects had to be considered. The first was the increasing federal intervention in education in the country. This issue was examined in Chapter 2. To attempt to analyze the causes affecting the overall mathematics education policy without proper consideration of the federal role would be a serious mistake. Federal intervention in education was strongly opposed by many who cited the Tenth Amendment as one of the most important reasons for their opposition. The reasoning was that according to the constitution all the powers that were not specifically given to the federal government resided with the states.² It was also felt that local schooling was best left to local decision-makers. Finally, it was believed that federal intervention was not necessary because local authorities, with help from their states, could provide proper education for their children.

¹ Joel Klein resigned as chancellor of the New York City Department of Education on November 9, 2010 after eight years on the job.

² The Tenth Amendment was being cited here.

Despite the arguments against federal involvement in education, however, the government was able to break new ground in 1958 with the National Defense Education Act (NDEA). This law, though limited in the level of intervention when compared with some of the later pieces of legislation (as for example the Elementary and Secondary Education Act, 1965), was indeed a major turning point in the history of education in the United States. Even though it favored higher education and allocated substantial federal funds to it, the NDEA did provide some funding for K-12 education.

Notwithstanding the broad acceptance that there was a need to improve mathematics and science education in the country, the NDEA became acceptable to Congress only when President Eisenhower introduced it as a part of national defense. It is believed by some historians that he was able to succeed because of the scare caused by the Soviets when they launched the first unmanned space satellite in October, 1957. Others disagree. They pointed out that prior to 1958 there had been a great deal of discussion and debate about the federal government's intervention in education and, according to Kaestle, a Bill similar to the NDEA had been incubating well before 1958.³ It would seem, however, that the actions of the Russians did tip the scale in favor of its passage.

The successful passing of the NDEA and its general acceptance in the country emboldened the federal government to attempt another piece of legislation which further extended the federal role in education with far reaching consequences. This bill, which became the Elementary and Secondary Education Act (ESEA), was passed in 1965, seven years after the landmark NDEA. President Lyndon Johnson was able to obtain passage of the ESEA because

3. McGuinn, *No Child Left Behind*, 25.

Congress was favorable to him at the time and because he also carefully avoided the mistakes made by his predecessor, President Kennedy. Although he made valiant efforts to have his election promises on education fulfilled, President Kennedy was confronted by obstacles at every turn and it was left to President Johnson to find a way to have the legislation passed.

The federal role in education gradually increased over the period. Even when it appeared that there would be a reversal of previous legislation, public opinion prevented such a reversal. The movement of the federal role, though “zig-zag” at times, was decidedly towards greater involvement by the federal government in education. In the period from 1961 to 1981, that is, from the beginning of the Kennedy era to the end of the Carter era, there was decidedly an increasing federal involvement in education. However, when President Reagan took office there was a distinct shift in the federal policy on education.

The ESEA was extremely attractive to many states and school districts because its five programs provided what was said to be previously unimaginable sums of aid for schools.⁴ Title I was the centerpiece of the ESEA. It was very important because it aimed to improve not only educational opportunities but also educational outcomes for disadvantaged children. This program received \$1.06 billion of the initial \$1.3 billion appropriated for the ESEA. While it has continued to provide funding for many educational programs, it has had its fair share of criticism. The major criticism of the ESEA is that although its intention was to provide support for the education of socioeconomically disadvantaged children, it has been consistently unable to close the achievement gap between poor and affluent students.

4. McGuinn, *No Child Left Behind*,

The federal intervention in education continued to expand. This continuous movement culminated with the passage of the No Child Left Behind Act (NCLB) 2001 which further deepened the federal role in education. The NCLB was at that time the latest reauthorization of the ESEA. While in the previous pieces of legislation the government did not try to enforce any compliance, in this law the government showed some teeth. The NCLB made accountability mandatory if local education authorities accessed federal funding for their programs.

The Bifurcation of the 9th Grade Syllabus and the “New Math”

Chapter Three takes up another important issue which shaped the direction of mathematics education policy in New York City. This was the advent of the “new math” curriculum. Although the New York City mathematics curriculum was not completely reformed to adopt the “new math” in its entirety, some selected topics from the “new math” curriculum were introduced in an effort to improve mathematics education in the city. These were introduced in the new curriculum that was being developed for the New York City school system in 1958.

At that time the new curriculum which was prepared for the middle school focused particularly on the 9th grade. The emphasis was placed on developing the most appropriate curriculum for this grade because it was viewed as the one which prepared the student for high school. Further, there was a division of the 9th grade curriculum into Mathematics 9th Year and General Mathematics 9th Year. The students who were thought to be college-bound were allowed to use the Mathematics 9th Year syllabus; while the General Mathematics 9th Year syllabus was prepared for those students who were found to be uncomfortable with mathematics, or who were considered to be slower, and/or who were not expected to attend college.

The curriculum planners had become convinced over the years that no single mathematics course of study could adequately serve the needs of all pupils in the 9th grade. Thus, in an effort to bring it closer to what was the current thinking at the time, some new topics adopted from “new math” were introduced into the Mathematics 9th Year curriculum. Even then the syllabus still placed some emphasis on arithmetic. The General Mathematics 9th year course, on the other hand, was very basic, clearly indicating that it was the belief in some quarters that not all students were able to benefit from topics in the “new math” curriculum. This bifurcation of the 9th grade syllabus was indeed a form of tracking, intentionally or unintentionally.

The traditional mathematics curriculum was based on Life Adjustment education. It was not unexpected, therefore, that problems in the General Mathematics 9th Year would be based on that concept. This clearly showed that even up to the late 1950s there was some influence of Life Adjustment on the mathematics curriculum. By that time, however, life adjustment was being severely criticized by many writers. Kliebard referred to it as “that dismal chapter in the history of educational reform,” while Ravitch saw it as “unabashedly anti-intellectual” and she considered the entire program that was based on life adjustment to be regressive and undemocratic.

The fact is that in the late 1950s to early 1960s the prevailing view was that the “new math” was the most advanced mathematics curriculum. It was felt by many in the mathematics education community that the “new math” would solve all the problems that were being experienced in mathematics education in the country. It was supposed to be based on the most up to date research in educational psychology and as such it was considered the ideal curriculum.

Although there was a great deal of excitement about the “new math,” the middle school mathematics curriculum in New York City changed very little. Curricular reform was sometimes

met with resistance since any change tended to be viewed with some distrust. Hence, it was not an easy task to bring about any substantial reform in mathematics educational in the New York City school system.

The Back to Basics Movement

Around the early 1970s many parents, teachers, and prominent members of the mathematics education community became disillusioned with the “new math.” They felt that from the start it had been a dismal mistake. Furthermore, they were worried that students were not being equipped to perform the very basic computations that were necessary in daily life. To make matters worse, there were others who expressed dissatisfaction with the performance of average and below-average students. These various factions of dissent and dissatisfaction became unified over the burning question of the ideal school mathematics curriculum. As a result they launched a campaign for a return to the basic mathematics curriculum.

There were three events which helped to reduce the efforts of the supporters of the “new math” and so made it easier for those who favored the “back to basics” movement to promote their cause. The first was the closing of the most successful academic group sponsoring the “new math,” the School Mathematics Study Group, (SMSG) in April 1972; the second was the untimely death of Professor Max Beberman, head of the University of Illinois Committee on School Mathematics (UICSM); and the third was the reduction in funding from the National Science Foundation (NSF), the government agency that had funded many of the “new math” projects. All these developments helped to further the aims of the “back to basics” movement, as these events greatly diminished the efforts of those who favored the “new math.”

In New York City however, the mathematics curriculum did not appear to be greatly affected by the “back to basics” movement; as was discussed in Chapter 3, the traditional

curriculum had remained intact, except for a few topics, throughout the “new math” controversy. This was particularly true of the General Mathematics 9th year syllabus, which had retained its original form with almost no change. In the Mathematics 9th Year syllabus there had been the introduction of a few “new math” topics. Apart from that, the middle school mathematics curriculum remained essentially the same for most students in the city throughout the 1970s. They were therefore not too affected by the “back to basics” movement.

The Standards Movement

Towards the mid-1970s another concern involving the direction of mathematics education was being raised. There seemed to be much uncertainty about the direction of mathematics education. To some writers, mathematics education appeared to be in limbo as the mathematics education community groped for a clearer focus and sense of direction. Mathematics education in the country, then, appeared to be in a state of disarray. These concerns eventually gave rise to publications such as *An Agenda for Action*, by the NCTM in 1980, and *A Nation at Risk*, by the National Commission on Excellence in Education (NCEE) in 1983. These publications helped the nation to focus on what was needed to improve mathematics education in the country.

As indicated above there was some uncertainty about the “back to basics” curriculum and as such the “back to basics” movement did not find favor with everyone. Therefore in 1989 the National Council of Teachers of Mathematics published an all-embracing set of mathematics standards entitled, *Curriculum and Evaluation Standards for School Mathematics*. This publication was updated in 2000 by the *Principles and Standards for School Mathematics*. These standards became the driving force in mathematics education. As a matter of fact, most states’ standards were later developed based on these NCTM standards.

Both the New York State Standards and the New York City Standards were based on the NCTM Standards. These standards were developed in an effort to guide teachers in the teaching of mathematics and to assist students in learning mathematics. The hope was that some of the problems faced by the mathematics students in the New York City middle school, in particular, the declining scores as they entered the middle grades, and the achievement gap between privileged and underprivileged students, could be resolved as a result of these new standards.

The Recurrent Teacher Shortage

Another major problem which the New York City school system faced during the period was the recurrent shortage of mathematics teachers. In some instances there was a general shortage of teachers in almost every subject area. However the shortage was usually in mathematics and science. In addition the city often found the junior high schools much harder to staff than either the elementary schools or the high schools. For example, in the fall of 1954 out of a total number of 5032 teaching positions in the junior high schools, 1500 were filled by substitutes and another 460 by elementary school teachers. A year later, in 1955, there were well over 2200 persons who did not have the required license teaching in the junior high schools.

In the early years of the period part of the blame for the shortage of teaching staff went to the Board of Examiners, which at that time was responsible for administering tests to prospective public school teachers. It was identified by many people in the education community in New York City as the major cause of the teacher shortage because of its lengthy testing policies. Whether it was correct to assign all this blame to the Board of Examiners is difficult to ascertain, since what was also true at the time was that suburban school districts were offering teachers higher salaries than those being offered in the city. As might be expected, qualified teachers preferred to teach outside of the city.

The shortage continued well into the next decade, a development evidenced by the fact that in January 1966 Dr. Theodore Lang, Deputy Superintendent of Schools, predicted that in September of that year the junior high schools would need to fill 346 positions mandated by UFT contract, and 964 others for a total of 1310 staff positions.⁵ He anticipated that there would be 980 appointments and that would leave 330 positions unfilled.⁶ It is worth noting that the number of substitute teachers at that time was considered to be as high as 40 percent of the teaching staff. However the critical shortage area then was not in mathematics but in other content areas.

The shortage of mathematics teachers arose also because college graduates with degrees in mathematics had more lucrative opportunities available to them than those offered in the field of education. This situation was discussed by Levin; and although his work referred to the country as a whole, urban cities like New York were particularly susceptible.⁷ He found that in 1973-74 the estimated annual salary advantage to someone with a Bachelors degree in Mathematics who chose business and industry as a career over education was \$5417. Obviously, this was in some cases sufficient incentive not to select teaching as a career.

The trend continued, and the decade of the 1980s saw the city with a shortage of mathematics teachers. As a result, in 1984 the New York City Board of Education created the Mathematics and Science Re-Licensing Program to try to solve the problem. This program took a new approach to replenishing the mathematics and science teachers in the city schools. In this new approach the board decided to retrain some of the teachers already working within the

5. The 964 other vacancies were expected to come from cessation of service for various reasons by regularly appointed teachers.

6. Minutes of the Meeting of the Ad Hoc Committee of Recruitment, Training, and Promotion of Teachers and Supervisors, New York City Board of Education, January 17, 1966.

7. Levin, *Solving the Shortage of Mathematics and Science Teachers*, 1985, 375.

system. The idea was to retool teachers from such overstocked fields as English, history, and elementary education and prepare them for teaching positions in mathematics.

The late 1990s saw the school system in the same predicament, and again efforts were made by the New York City school system to resolve the problem. The first such effort to reduce the shortage of mathematics teachers this time was the attempt to attract some of them from overseas to teach in New York City. This international effort began in 1998 when some members of the City College School of Education were able to encourage twenty-five mathematics and science teachers from Austria to come to New York to teach in the city.

The next effort was the Teacher Opportunity Program (TOP) carried out by the City College of New York. In this program, individuals who had majored in mathematics but had not done any education courses were offered a free masters degree to complete their training in education. This made them eligible for certification to teach in the public schools of the city. The TOP program represented a collaborative initiative between The City University of New York and the New York City Department of Education. Participating colleges included Brooklyn, City, Hunter, Lehman, Queens and the College of Staten Island.

The third program was the New York City Teaching Fellows (NYCTF), which was started in August 2000 as a result of the acute shortage of certified teachers in all content areas. The situation was made worse by a court order resulting from the successful lawsuit of the New York State Education Department, an order which translated into a need for 12000 newly certified teachers by September, 2001. It would seem that the NYCTF was started in anticipation of the court order. All this was in response to the NCLB, which mandated that there must be a certified teacher in every classroom.

The Declining Mathematics Scores in the Middle Grades

The most conspicuous theme emanating from the study of the period is the fact that there was a persistent gap in the mathematics scores as the students left the elementary grades and entered the middle grades. This pattern occurred throughout the period. As was shown in Chapter 5, the various chancellors had agonized over this problem. They had all tried with little success to remedy the situation. Hence, one of the main concerns of New York City's education system was the consistent decline in mathematics achievement in the middle grades.

The mathematics scores in the middle grades tell a very sad story. From these scores it can be observed that throughout the period there was a noticeable decline as students moved up through the middle grades. This was identified by Richard Guttenberg, the Director of Educational Assessment, when, in analyzing the results of the 1986 citywide mathematics test, he made particular mention of the fact that the students' achievement was quite consistent up to grade 6, but then there was a sharp drop-off in grade 7. This was very similar to the response expressed earlier by Chancellor Frank Macchiarola when, referring to the results of the 1985 citywide mathematics test, he claimed that what was being seen was a good sign up to the sixth grade but not good after that.⁸

A Report from the New York City Board of Education in 1989 claimed that the relatively low scores in the middle grades highlighted the need for emphasis at these grades, and that there was the need for continuity in instruction and methodology as students leave the elementary schools to enter intermediate and junior high schools. It was also a concern to the State

8. Maeroff, Math in City Schools, *New York Times*, May 30, 1981.

Education Department since the students in the eighth grade needed to be ready for the Regents examination in four years to be able to graduate from high school.

Findings

The federal involvement in education over the years did bring about some changes to middle school mathematics content and pedagogy in New York City. Firstly, although the NDEA provided most of its funding for higher education and only a small part (about 10%) for K-12 education, middle school mathematics education in New York City did benefit as a result of the overall improvement in the learning and teaching of mathematics. The increased emphasis on the study of mathematics, which was led by the federal government through its considerable appropriation to institutions of higher education, helped to place mathematics education firmly in the New York City school curriculum.

Further, even though most of the New York City mathematics curriculum remained very traditional during the “new math” period, there were some areas of the “new math” which were in fact implemented from the curricula developed by curriculum writing groups with funding from the government sponsored NSF. Also, as discussed in Chapter 2, the purpose of the ESEA was primarily to be a redistributive bill, intended to put a floor under the nation’s poorest communities. The Act was designed to assist in the improvement of education as a whole, unlike the NDEA, which provided mainly for mathematics and science education. However the additional funding provided for training and resources did bring tremendous benefit to middle school mathematics education in the city. Finally the NCLB, with its demand that there must be a certified teacher in every classroom, ensured that the mathematics students in middle school in New York City had the benefit of competent and qualified teachers.

In Chapter One I pointed out that it is necessary in a study like this to investigate whether the middle school mathematics education policy in New York City has advantaged some and disadvantaged others. The fact seems to be that there is no evidence to indicate one way or the other. What can be said, however, is that the students who performed well at the beginning of the period continued to do so. The students who were performing poorly also continued to do so. A good example is provided by the students in District 26 who returned stellar performances during the period while those in District 32 had less than average scores throughout the period. The experts pointed to the difference in the socioeconomic status of the two communities, but funds released by such Acts as the ESEA were supposed to assist in the closing that gap. This did not happen.

I also expressed concern in Chapter One over the decline in mathematics scores in the middle grades and the overall low scores on the standardized tests; these concerns still remain at the end of the period. The first worry is with the decline in students' mathematics scores as they enter the middle grades. In the mid-1980s both Chancellor Frank Macchiarola and Richard Guttenberg, the Director of Educational Assessment, highlighted this problem. This anomaly continued well into the 1990s; and in an attempt to counter this trend the state introduced a new eighth grade standardized mathematics test in 1999. However at the end of the period there was little change.

Another major worry was the overall low scores on the standardized mathematics tests. As far back as 1972 the overall New York City students' scores on the state mathematics test placed 35 percent below the reference point. This situation remains the same, completely defying all the efforts of the education authorities to remedy it. In 1991 Chancellor Joseph Fernandez was elated because about 60% of second through eight graders had scored at or above grade level.

Even then there were wide gaps in the scores. There were 70% of the grade 5 students scoring at or above grade level, while only 43% of the 8th grade students achieved the required standard. By 2002 the citywide results showed that only 37% of the students in grades 2 through 8 reached the required standard. While it is difficult or well nigh impossible to compare students' performance on different tests or over different periods, the fact is that if students consistently score below grade level on the various tests then there is a problem with either the testing or the teaching, or both.

Finally, it would seem that even though there were many attempts to improve the teaching and learning of mathematics in New York City middle schools, not very much appears to have worked. In 1958 the middle school mathematics students' performance was below standard. Forty-one years later, in 1999, the State Commissioner, Richard Mills, believed that the low scores in the middle grades and the high failure rate at the Regents examination were definitely linked. The achievement gap, of which so much has been written, continues to plague the middle schools in the city. In 1955 an acute teacher shortage was reported; forty-five years later the New York City Teaching Fellows program was initiated in an attempt to solve the teacher shortage problem. It may be true to say, then, that the more things change the more they remain the same.

In conclusion, there were several factors, both local and national, which drove New York City middle school mathematics education policy. The local factors--the attempts to arrest the decline in middle school scores, to close the achievement gap, and to deal with the teacher shortage--were not unique to New York City, since many other large cities experienced similar situations. What made New York City special was the sheer size of its school population. National factors, on the other hand, forced local education authorities to act in particular ways.

For example, the general federal intervention (NCLB for instance) forced the school authorities in New York City to change their policies to align with federal mandate in order to avail themselves of the opportunity to receive federal funds.

It is reasonable to conclude, then, that the New York City middle school mathematics education policy is the result of a combination of both local and national causes. These policies, however, have failed to produce the desired results. The reason for this failure is probably because these policies have brought about reform in a piecemeal manner. To borrow Tyack's word, maybe there should be no more 'tinkering' in this piecemeal manner but perhaps a more comprehensive approach to reform not only of the mathematics curriculum but of the entire public school system in the city.

APPENDICES

Appendix A

New York City School Superintendents

William H. Maxwell	1898-1918	20 years
William L. Ettinger	1918-1928	10 years
William J. O'Shea	1928-1934	6 years
Harold G. Campbell	1934-1942	8 years
John E. Wade	1942-1947	5 years
William Jansen	1947-1958	11 years
John Theobald	1958-1962	4 years
Bernard Donovan	1962-1963	1 years
Calvin Gross	1963-1965	2 years
Bernard E. Donovan	1965-1969	4 years

Chancellors

Irving Anker	1970	
Harvey Scribner	1970-1973	3 years
Irving Anker	1973-1978	5 years
Frank Macchiarola	1978-1983	5 years
Richard Halverson	1983	
Anthony Alvarado	1983-1984	1 year
Nathan Quinones	1984-1987	3 years

Charles Schonhaut	1988	
Richard Green	1988-1989	1 year
Bernard Mecklowitz	1989	
Joseph Fernandez	1990-1993	3 years
Harvey Garner	1993 (interim July-August)	
Ramon Cortines	1993-1995	2 years
Rudolph Crew	1995-1999	4 years
Harold Levy	2000-2002	2 years
Joel Klein	2002-	

Appendix B

Board of Education Presidents

Charles Silver	1955-1961
Max J. Rubin	1961-1963
James B. Donovan	1963-1965
Lloyd Garrison	1965-1967
Alfred Giardino	1967-1968
Rose Shapiro	1968-1968
John Doar	1968-1969
Joseph Montserrat	1969-1970
Murry Bergtraum	1970-1971
Isaiah Robinson	1971-1972
Stephen Aiello	1973-1974
Isaiah Robinson	1975-1976
Stephen Aiello	1977-1979
Joseph Barkan	1980-1983
James Regan	1983-1986
Robert Wagner	1986-1989
Gwendolyn C. Baker	1989-1990
H. Carl McCall	1990-1993
Carol Gresser	1993-1996
William Thompson	1996-2001
Ninfa Segarra	2001-2002

Appendix C

Mayors of New York City, 1958-2002

Robert F. Wagner Jr.	1954-1965
John V. Lindsay	1966-1973
Abraham D. Beame	1974-1977
Edward I. Koch	1978-1989
David N. Dinkins	1990-1993
Rudolph W. Giuliani	1994-2001
Michael R. Bloomberg	2002

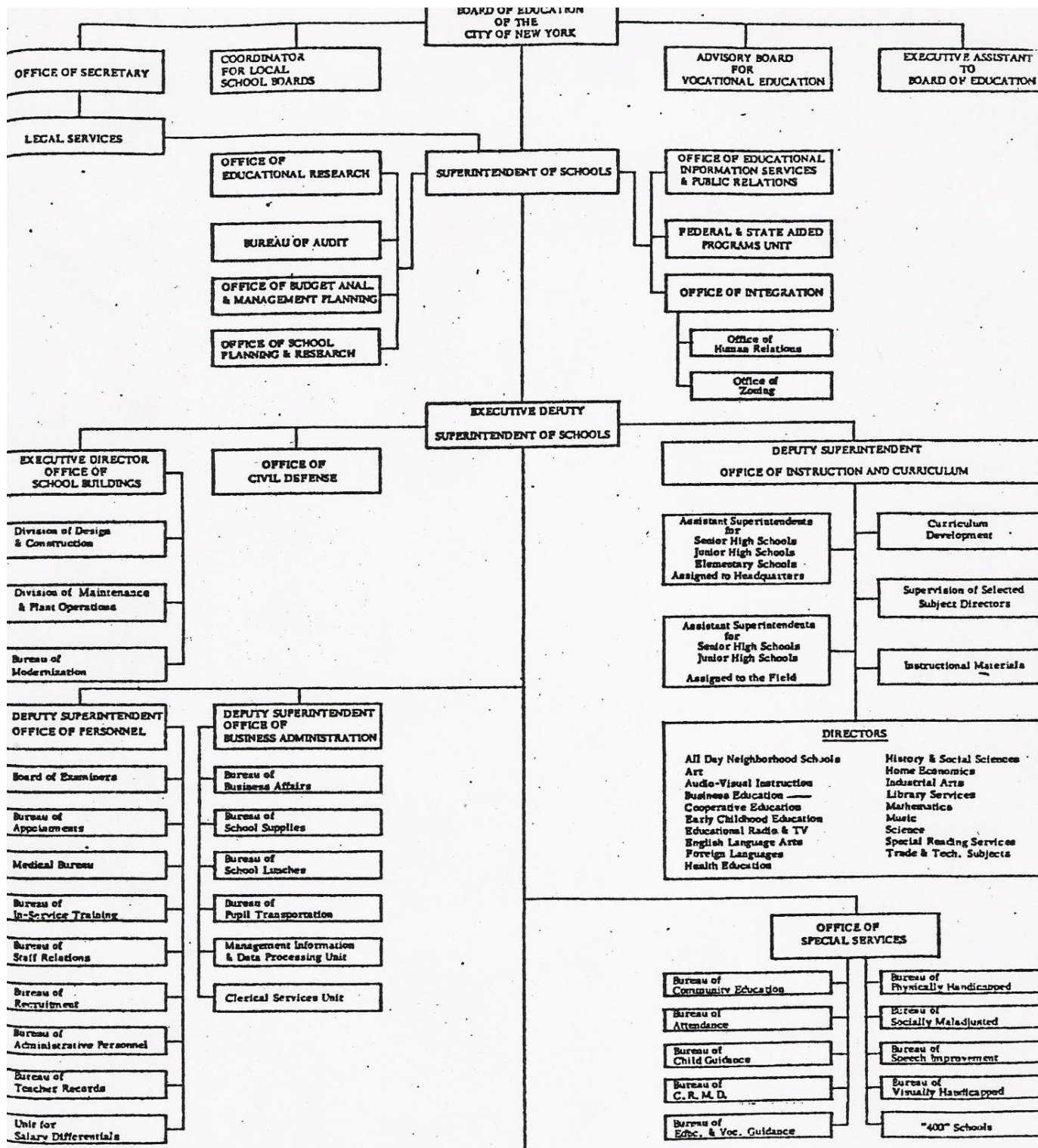
Appendix D

Chronology of the Public Schools of New York City

1784	The Board of Regents of the University of the State of New York is created.
1787	Erasmus Hall Academy (now Erasmus Hall High School) is chartered by the Regents (tied with an upstate school as the first to be chartered).
1805	The Free School Society, under its president DeWitt Clinton, is organized to provide free education in New York City, especially for poor children not otherwise provided for. Governed by a voluntary board of trustees.
1826	The Free School Society is reorganized and renamed the Public School Society.
1842	The Legislature creates the Board of Education, to operate a system of public schools in New York City (public in the sense of government-owned as well as open to the public). The legislation provides for commissioners, trustees, and inspectors to be elected in each ward and for each ward to send representatives to the central board.
1843	The Board of Education of the City of Brooklyn is created, to consolidate management over the previously established local district schools.
1847	The Free Academy is opened in New York City, under the control of the Board of Education, to provide secondary education. Later, it becomes City College.
1853	The Board of Education absorbs the Public School Society, including its school buildings and other property. In creating a unified system, many schools are re-numbered.
1855	The City of Brooklyn annexes Williamsburg and its schools are merged into the Brooklyn system.
1870	The Normal College is created to offer teacher training programs (later named Hunter College after its first president, Thomas Hunter).
1871	In a move to “mayoral control”, the Board of Education is abolished and superseded by a Board of Public Instruction appointed by the Mayor, who

(continued on next page)

	also appoints ward inspectors and trustees.
1873	In another reorganization, the Board of Education is re-established, but is still appointed by the Mayor, although ward trustees are now appointed by the new board. The Mayor continues to hold at least part of the appointive power through the many changes in structure over succeeding decades.
1896	The system of ward trustees is eliminated, with authority being consolidated into the central Board of Education.
1898	Greater New York is created through consolidation of New York, Brooklyn, Queens, Bronx, and Richmond. The Consolidation legislation creates two levels of school governance: a central Board of Education and School Boards for the several boroughs, with divided responsibility.
1902	The "Revised Charter of 1901" goes into effect. The borough school boards are eliminated and responsibility is centered in one city-wide board and its City Superintendent of Schools and Superintendent of School Buildings.
1916	The New York City Teachers Union is formed. It does not have a collective bargaining contract, but serves as a lobbying group for teacher interests and school reforms. Its role declines in the 1950s as it is attacked as communist-influenced.
1921	The United Parents Associations is organized, an umbrella group of school-level parents associations.
1960	The United Federation of Teachers is organized; in 1961 it wins the referendum to hold collective bargaining rights for New York City teachers and continues to represent them ever since.
1967	Three "demonstration districts" are created as an experiment in community control of schools; controversy over the role of their governing boards leads to a teachers' strike in 1968.
1970	Decentralization legislation goes into effect. Thirty-two elected Community School Boards acquire responsibility for elementary and junior high schools. The central Board of Education retains many general powers, especially regarding budgets, and exercises direct responsibility for high schools. The central board consists of two members chosen by the Mayor and one by each Borough President. The central board appoints a Chancellor as chief administrator.
2002	The Board of Education and the elected Community School Boards are abolished. The Schools are to be governed directly by a Chancellor appointed by the Mayor to be head of a new Department of Education.



Appendix E

Appendix F

Unit 22

6.14.08 REVIEW: DIVISION

(1 lesson/ongoing)

PERFORMANCE OBJECTIVES

The student will be able to...

6.14.08.01 divide a 4- or 5-digit dividend by a 2-digit divisor and check;

e.g.,

		<u>Check</u>
$\begin{array}{r} 268 \\ 24 \overline{)6433} \\ \underline{-48} \\ 163 \\ \underline{-144} \\ 193 \\ \underline{-192} \\ 1 \end{array}$	or	
$\begin{array}{r} 268 \\ 24 \overline{)6433} \\ \underline{-4800} \\ 1630 \\ \underline{-1440} \\ 193 \\ \underline{-192} \\ 1 \end{array}$	(200x24)	268
	(60x24)	<u>x24</u>
		1072
		<u>5360</u>
		6432
	(8x24)	<u>+ 1</u>
		6433

The answer is $268\frac{1}{24}$.

6.14.08.02 create and solve word problems related to skills learned in this module.

e.g.,

A citrus packing plant shipped 10,125 oranges. If they used 45 crates, and placed the same number of oranges in each crate, how many oranges were in each crate?

Appendix G

7.01.03 PALINDROMES

(2 lessons)

PERFORMANCE OBJECTIVES

The student will be able to...

7.01.03.01B

identify a palindrome as a whole number whose decimal numeral is made up of a sequence of digits that read the same left to right and right to left;

e.g.,

737 51315

7.01.03.02C

create a palindrome by repeated additions with reversed numerals;

e.g.,

pick	86	
reverse it	<u>+ 68</u>	
	154	no palindrome
reverse it	<u>+451</u>	
	605	no palindrome
reverse it	<u>+506</u>	
	1111	palindrome

7.01.03.03D

classify a number by the number of such additions needed to create a palindrome; starting with the given number.

e.g.,

86 is a "class 3 number" because three reversed-numeral additions are necessary to create a palindrome, starting with 86.

Appendix H

8.14.10 REVIEW: VOLUME AND CAPACITY

(1 lesson/ongoing)

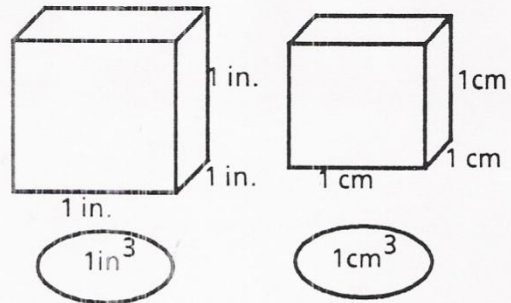
PERFORMANCE OBJECTIVES

The student will be able to...

8.14.10.01

identify the cubic inch (in.³) and the cubic centimeter (cm³) as standard units of measure of volume;

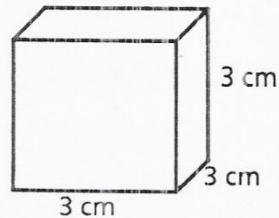
e.g.,



8.14.10.02

compute the volume within a cube by using the formula $V = e^3$;

e.g.,



$$V = e^3$$

$$V = 3 \cdot 3 \cdot 3$$

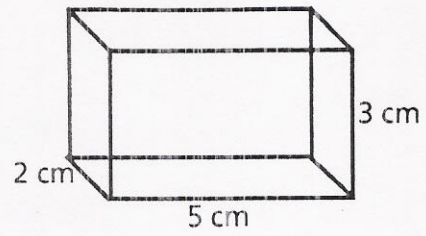
$$V = 27$$

The volume is 27 cubic centimeters.

(continued on next page)

8.14.10.03

compute the volume enclosed within a rectangular prism by using the formula $V = lwh$.



$$V = lwh$$

$$V = 5 \times 2 \times 3$$

$$V = 30$$

The volume is 30 cubic centimeters.

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