DOCUMENT RESUME

ED 306 126 SE 050 531

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TITLE Teachers on the Board: The Cleveland Collaborative for Mathematics Education.
SPONS AGENCY Ford Foundation, New York, N.Y.; Wisconsin Center for Education Research, Madison.
PUB DATE 89
NOTE 55p.; Paper presented at the Annual Meeting of the American Educational Research Association (San Francisco, CA, March 27-31, 1989).
PUB TYPE Reports - Descriptive (141) -- Viewpoints (120) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Cooperative Education; Mathematics Curriculum; Mathematics Education; Mathematics Instruction; *Mathematics Teachers; Professional Development; Secondary Education; *Secondary School Mathematics; *Teacher Centers; *Teacher Improvement; Urban Education; *Urban Schools; *Urban Teaching
IDENTIFIERS *Cleveland Collaborative for Mathematics Education

ABSTRACT

The Cleveland Collaborative for Mathematics Education (C2ME) intends to change the role and status of teachers of mathematics in Cleveland's public secondary schools. This report presents the perceptions, beliefs, and practices of the teacher members of the collaborative project. This research is based upon descriptive and historical data gathered from observations and interviews of teachers, principals, curriculum specialists, and students in the city's junior and senior high schools. The findings of this study are presented from the perspective of a mathematics teacher. The report begins with a description of the C2ME, which is followed by a presentation of the teacher's schedule and typical teaching day, and then presents details about urban youth and the problems faced by teachers of mathematics. Section II presents the teacher's view of the collaborative project as an important mechanism that provides support and direction for the reform of teaching mathematics. Finally, Section III covers three themes suggested by the data analysis that help to interpret the effects of the collaborative project: systematic management and technique; the homework curriculum; and the ideal department chair. The report closes with a summary of the findings, and a discussion of methodology. (YP)

Presented in the Curriculum Studies Division at the Annual meeting of the American Educational Research Association, March 27 - 31, 1989 San Francisco, California.

Teachers on the Board:

The Cleveland Collaborative for Mathematics Education

by

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Teachers on the Board:

The Cleveland Collaborative for Mathematics Education

I. Introduction

The Cleveland Collaborative for Mathematics Education (C^2ME) intends to change the role and status of teachers of mathematics in Cleveland's public secondary schools. Established in 1985, it was one of the first of the 11 Urban Mathematics Collaborative projects funded by the Ford Foundation. Now entering its fourth year of operation, the project is showing signs that it has achieved some level of success in redefining the role of the mathematics teacher in relation to essential features of the profession, including work scheduling, curriculum planning, methods of instruction, and organizational development. For teachers, these are the terms of empowerment and professionalism.

This is a report about the effects of the C^2ME on teachers and their professional practices. More specifically, it presents the perceptions, beliefs, and practices of the teacher members of the collaborative project in Cleveland, Ohio. To help guide this investigation, this report centers on two key questions: What is it like to work on a daily basis as a teacher in the collaborative? What are the teachers' conceptions of mathematics and the teaching of mathematics? It is my intent to create in the mind of the reader a vivid impression of the daily activities of these teachers, a clear understanding of the circumstances in which they work, and a general sense for the way in which they think about mathematics.

This research is based upon a field study, during which I devoted extended periods of time to recording descriptive and historical data gathered from observations and interviews of teachers, principals, curriculum specialists, and students in the city's junior and senior high schools. The field study began on January 15, 1988, and was completed on May 31, 1988.

The findings of this study are presented from the perspective of James T. Engle, a pseudonym for one of the mathematics teachers in Cleveland. The report begins with a description of the C^2ME, which is followed by a presentation of Mr. Engle's schedule and typical teaching day at North Coast High School (also a pseudonym). I then present details about urban youth and the problems faced by teachers of mathematics. Section II presents Mr. Engle's view of the collaborative project as an important mechanism that provides support and direction for the reform of teaching mathematics in the Cleveland Public Schools. Finally, Section III covers a variety of themes suggested by our data analysis that help to interpret the effects of the collaborative project on the mathematics teachers in Cleveland. The report closes with a summary of the findings, and a discussion of methodology.

In brief, the collaborative's greatest impact has been its success in rejuvenating the city's mathematics teachers. They have benefitted from the opportunity to join other professionals in a decision-making process that is close to the heart of their work as teachers. Their regular association with other mathematics teachers in the district has led to productive and meaningful forms of collegiality. Despite these advances, however, the district's curriculum and instruction continue to be hindered by systematic instructional programming, traditional conceptions of teaching and learning,

and serious attendance problems. It is in this area that the Urban Mathematics Collaborative Project must help the C^2ME have an impact next.

The C^2ME

The Cleveland Collaborative for Mathematics Education (C^2ME or collaborative) was one of five collaboratives established in urban communities in 1985 with support from the Ford Foundation. It is the goal of the C^2ME to improve the working conditions and professional practices of secondary mathematics teachers in the Cleveland Public Schools. With collaborative support, mathematics teachers have worked to improve their use of community resources to enhance their instructional program, and to find new models for promoting their own professional growth.

The collaborative is administered through the Cleveland Education Fund. Its Advisory Board, which oversees the collaborative's day-to-day operations, is comprised of leaders from local business and industry, university personnel with a background in education or mathematics, and mathematics teachers from the city's junior and senior high schools. The collaborative's Teacher Advisory Board, which provides assistance in developing long-range plans, focuses largely on issues and problems faced by the district's mathematics teachers.

Since its inception in 1985, the collaborative has offered a variety of activities targeted to meet the needs of mathematics teachers in Cleveland's Secondary Schools. Examples include training sessions in the use of calculators in mathematics instruction, seminars in the role of mathematics in business or industry, and workshops on teaching methods and classroom management techniques. The collaborative also provides encouragement and technical assistance to teachers interested in developing and submitting

grant proposals to fund classroom projects and to defray the cost of their attendance at workshops and conferences. In general, the collaborative aims to provide teachers with high quality training and information about mathematics, and to create opportunities for collegiality and networking with leaders in business, industry, and education.

One of the Cleveland collaborative's most important successes has been its Mathematics Teachers Resource Center, located on the Cuyahoga Community College metro campus (CCC or Tri C). Built in 1963, the CCC complex is surrounded by courtyards and expanses of lawn, a park-like environment rare in inner-city Cleveland. The campus, easily accessible by car, bus, and train, is located in close proximity to several fast food restaurants and small shops. The Cleveland State University campus is three blocks north. The downtown area of Cleveland, with its shops, state and federal office buildings, theaters, and restaurants, is five or six blocks north and west.

The Resource Center offers teachers a well-furnished, aesthetically appealing, and business-like place to explore curricular resources, to engage in discussion with colleagues, and to produce instructional materials. The Center's space is approximately 20 feet long by 15 feet wide. Tables, line the walls, and new state-of-the-art office equipment, including three computers, a laser printer, and a desktop copy machine, is available. Two tables with chairs are situated in the center of the room. Bookshelves are filled with textbooks and mathematics reference volumes, and a bulletin board is crowded with announcements, a calendar, scenic posters, and the collaborative newsletter. The floor is carpeted, the walls are white.

The School Setting

Cleveland's public junior and senior high schools are located in different sections of the city, but they have a single, predominant characteristic in common: they are located in settings of stark urban poverty. A majority of students who attend the Cleveland City Schools come from circumstances of serious economic and educational disadvantage.

The school described in this report is surrounded by small, ill-kept, wood-frame houses. Some of these houses are single-family homes, some are two- or three-family apartments, and others are single-family homes that serve as dwellings for diverse groupings of people. Automobiles in various states of disrepair line the streets and clutter the driveways. Tires and broken auto or appliance parts are strewn along the sidewalks. Beer cans and liquor bottles litter the lawns. Small children can be seen playing all day in their cribs at some of the second story windows.

Within a few blocks of the school is a business district, where bars and striptease lounges compete for space with new- and used-furniture stores, cafes, and appliance repair shops. Pimps, prostitutes, and drug users and pushers roam the streets. Within two or three blocks, delapidated warehouses and industrial buildings are largely vacant and disheveled. Junkyards and vacant lots dot the area.

The public school building that sits in the midst of this urban landscape reflects its surroundings. Graffiti scars its walls and doors. Where windows once offered students a view of the outdoors and provided a pleasing aesthetic effect to passersby, the glass has been replaced with opaque sheeting or brick. Steel doors mark the entrances in the dark brick walls of the building. Fences and gates erected to protect the building

itself and the vehicles of teachers and administrators are bent, torn and rusted. The sidewalks and asphalt surrounding the school are crumbling and covered with paper trash, cans, and empty bottles.

The Teacher's Work Place

North Coast High School (NCHS) has made no explicit determination of the maximum number of students it is equipped and staffed to serve. In response to the "Baby Boom" and "Boomlet," its enrollment has varied widely: In the past 20 years, the high school has reported a low enrollment of 1,200 and a high enrollment of 2,500. Today, most classes have 32-35 students. The school has one principal and one vice-principal; the number of support personnel varies each year, depending upon enrollment levels.

The architectural characteristics of NCHS are common to high schools nationwide. Its overall design seems to have been founded in an interest in the maintenance of order and there are sound reasons for maintenance of order in the school, the most important of which is the personal safety of students, teachers, and administrators.

The school's interior walls are covered in a whitish-yellow paint. In the hallways, a strip of fluorescent light fixtures casts a bluish-white light. The floor is covered in whitish terrazzo. The hard, bright substances reflect light and create echos. From inside the classrooms, one can hear the footsteps of a person walking alone in the corridor. Steel doors block the exits. A narrow, wire-mesh window allows all those entering or leaving the building to peek through and view the other side. A thick-link chain with a large padlock hangs from the quick-release handle on the inside; someone has gouged obscenities into its enamel paint. Here again, the walls are smattered with graffiti, much of it in the garish colors of

thick, felt-tipped markers. Here and there among the lockers, someone has torn a large hole in the steel sheeting and caved in the side of a locker at the corner.

Near exits and at the intersections of hallways stand uniformed guards, each carrying a walkie-talkie used to send information between the security personnel and the administration. After the bell announces the start of classes, students are not allowed in the hallways without a pass.

From time to time, these guards will race through the corridors in pursuit of students who have engaged in some infraction of the rules. At times the infraction is serious or criminal, such as theft, rape, even murder; more often, the students have been running and shouting in the halls, playing such ordinary childhood games as keep away, hide and seek, or catch. This type of rowdiness recurs often, despite the existence of rules prohibiting such behavior and the constant presence of the guards who enforce those rules. When caught, students typically shrug their shoulders and accept their punishment as a badge of courage or a trophy of independence and daring.

The hallways, relatively calm during instructional periods, explode once each hour into a cacophany of hollering and screaming, accompanied by the gross, rapid, physical movement of students to and from their classes. Always there is noise in the building: the constant buzzing of defective starters in the fluorescent lights, the dissonant clanging of the class change bell, the slamming of classroom doors, the thud of books dropping to the floor, the sounds of ripping paper, toppling desks, shouting teachers, slamming lockers, ringing telephones, blaring announcements on the PA

system, and students, screaming and shouting and stomping and skating and slapping.

During lunch hour, the noise level in the cafeteria is so intense that the teacher monitors can barely converse, despite their best efforts to shout above the din. Food fights and fist fights are standard occurrences. Four teachers and an administrator monitor the lunchroom activity of 100 to 200 students. The faculty and staff monitors, who stand guard at each of the entrances, frequently must chase after a student who has succeeded in sneaking out of the cafeteria.

The principal's office is flanked by a wooden counter, chest-high and 3 feet deep. On the other side of this counter are the principal's secretary and an assistant, who handle complaints, demands, or requests from students, teachers, parents, bus drivers, and so on. At the start of each day and during every class change, crowds of people charge through the principal's door and demand immediate attention. At times, the secretaries and the claimants shout angry threats at one another until the principal arrives to mediate or terminate these altercations. Posters on the office walls depict factory scenes that illustrate traditional maxims; hard work leads to success, honesty is the best policy, and effectiveness and efficiency are tandem virtues.

The school's restrooms have no door, only a blind entrance way; inside, the absence of doors on the individual stalls eliminates any semblance of privacy. The capacity of the restrooms is exceeded at regular intervals each day, and despite the efforts of maintenance personnel, they are dirty and malodorous most of the time. Here, too, graffiti competes with thick green paint for domination of the restroom walls.

Most of the teachers and staff arrive and leave promptly; all employers park their cars in a locked garage. Personal safety and security of property are two determining factors of the faculty's daily routine. Aside from a great bustle of activity in the morning when the students and educators arrive, and again in the afternoon as they depart, there is very little activity on the school grounds. But for the rows of cars in the parking lot and along side streets, a passerby would never guess that nearly 1,500 people crowd into the building every day.

Every teacher works in a variety of classrooms, one of which has a desk for his or her personal use. Typically, it is difficult to reserve time to use the desk without interfering with another teacher's class. Interaction between students and teachers is filled with good intentions, but often it is restricted to solving a problem in need of immediate attention. Time is usually too short to allow for an open-ended conversation or in-depth investigation of a personal or educational problem. The daily schedule, which begins at at 7:30 a.m., sets time aisde for appointments between teachers and students. A Homercom period runs from 8:58 to 9:19 a.m., late enough in the morning to ensure that the administration is including the maximum number of tardy students in its daily attendance report.

Teachers' records indicate that between one-third and two-thirds of their students are absent from class on a regular basis. It is not uncommon for only six or eight students to attend out of a class of 30. Teachers also report that some students regularly come as much as 30 minutes late to class.

Most meetings between teachers and students alternate from 40 minute homework lessons to entire classes and chance meetings in the hallways

during the 4 minutes between classes. Collegiality for many teachers is fostered during lunch time in the faculty lounge; staff interaction generally involves small talk, comments about the administration, and brief inquiries about individual students. Their 30-minute lunch period offers teachers an opportunity to take a break from the pressure and responsibility of managing their students, keeping the peace, and helping these young people learn.

II. THE TEACHERS AND THEIR VIEWS

James T. Engle is 45 years old. He has a Bachelor of Arts degree in mathematics education from the local state university and a Masters degree in mathematics from a local private college. He earned those degrees in the mid-1960s and is somewhat concerned about the extent of changes that have occurred in both education and mathematics since he completed his formal education; he is curious, for example, about when and how a teacher should introduce calculators and computers into mathematics instruction. In addition, he wants help with teaching methods that engage the attention of disadvantaged students and disciplinary procedures that are effective for maintaining acceptable student behavior. He has always hoped to continue his formal education in mathematics, but the demands of classroom teaching have left him with too little time and energy to pursue advanced graduate study.

Mr. Engle is married and the father of two children. He and his family live in an older, two-story wood-frame house in a quiet, residential area of Cleveland, about five miles from North Coast High School. He has worked at NCHS since obtaining his state certificate to teach in 1966. His wife,

Ellen, works as a dental assistant. Now that their kids are away at college, Jim and Ellen Engle have more time to spend together and to pursue personal interests.

As his involvement in the collaborative increased over the past four years, Mr. Engle said that he found himself spending more and more "quality time" in preparing for teaching. He set up a study in his basement and enrolled in a self-study course in computer programming so that he could take full advantage of the used Apple computer he purchased recently with a modest tax return. For the past two years, he has taught mathematics on a part-time basis at the local community college, filling in for regular faculty who are out on sabbatical or sick leave.

Teaching the night class at the college was a daring and rewarding move, according to Mr. Engle. The experience has taught him that his college students tend to exhibit some of the very same signs that his high school students have displayed: underdeveloped basic skills in mathematics, poor study habits, poor attitudes, and even poorer self-concepts in relation to mathematics. Discovery of the widespread nature of this problem encouraged Mr. Engle to search for new methods and materials pertinent at both educational levels and in both settings. The collaborative has offered him numerous opportunities to review new materials, consider different methods, and associate with colleagues who have experienced similar professional problems.

Mr. Engle's point of view wasn't always so optimistic. In the late 1970's, as the district initiated its reorganization effort in the face of court-ordered busing for desegregation, he seriously considered quitting the teaching profession. Like every new teacher, he had experienced a slate of

adjustment problems, such as maintaining discipline, generating enthusiasm, and writing lesson plans. But these were nothing when compared to the problems triggered by the "deseg plan." As a result of the plan, the high school lost most of its academic high achievers--among both black and white students--discipline problems increased, attendance decreased, the mathematics curriculum became more and more structured and controlled in response to district-ordered competency tests, and principals assumed the role of watchdog for the district's accountability movement.

Mr. Engle remembers himself as a frustrated teacher in those early days of his career. He still loved to talk about mathematics; indeed, nothing intrigued him more than puzzling out a word problem with an enthusiastic student. But he felt such students were few and far between in his classes, largely because the general climate in the school discouraged students from expressing interest in academic achievement and because the parents of high-achieving children had moved their families into the suburbs in search of a safer community and better schools. Another contribution to the talent drain, particularly among minority students, has been the recruitment at the junior high school level of high achieving boys and girls by prestigious private schools.

According to Mr. Engle, the student body and the instructional climate at North Coast High School have not changed very much in the past decade. While progress and improvement are possible, he says, frequent changes in the district superintendent's position, in combination with the economic and social problems this city has endured in the past two decades have produced and sustained these conditions. Mr. Engle considers himself somewhat insulated from the district administration, which has its offices downtown.

As things stand now, the high school will not be closed and the neighborhoods will not change overnight. "So what do you do?" Mr. Engle asks rhetorically. "You get involved with the C^2ME because it's here to help teachers make a difference in the quality of teaching mathematics."

Mr. Engle's Work Schedule

Mr. Engle teaches two sections each of three different mathematics courses: Consumer Mathematics, Introduction to Algebra I, and Geometry. His daily schedule is as follows:

Period	Time	Subject	Room
1 - 2	7:30-8:10	Algebra I	208
3 - 4	8:14-8:54	Cons Math	210
Homeroom	8:58-9:19		208
5 - 6	9:23-10:03	Algebra I	210
7 - 8	10:07-10:51	Preparation	215
9 - 10	10:55-11:39	Geometry	208
11	11:43-12:03	Lunch	Cafe
12 - 13	12:07-12:47	Preparation	215
14 - 15	12:51-1:31	Cons Math	210
16 - 17	1:35-2:15	Geometry	212

All teachers are expected to be in the school building by 7:05 a.m. and to remain there until 2:35 p.m. As the schedule indicates, Mr. Engle has two periods per day that he can devote to classroom preparation. One of these periods occurs immediately after lunch, which means that Mr. Engle has an hour each day away from his teaching responsibilities. He uses some of this time to coach students in mathematics. Each period is 40 minutes long, with 4 minutes between classes. Mr. Engle considers himself fortunate

because his classes are located in rooms that are on the same hallway and the same level. Some of his colleagues must hustle in the stream of students between classes in order to reach their next room assignments in other parts of the building.

A Typical Day

Mr. Engle leaves his home at 6:45 a.m. The drive to school usually takes about 10 minutes. He pulls his car into the school parking lot, making sure to check the locks before he leaves. "You never want to park your car on the street," Mr. Engle advises. "It'll be gone, if you do." This parking lot is surrounded by a high chain-link fence. A guard locks the gate about 9:30 a.m., anyone who wants to leave before the school day is over must locate the guard so that he can reopen it. Some of the faculty have installed steering column locks for added protection against the theft of their cars.

Mr. Engle goes directly to his desk in the mathematics department office, which is already open. As he picks up his materials for the first class, he offers his view of his own department.

> The department chair is always early. We are very lucky to have him. In some of the other schools the department chair does not support the collaborative. Ours is heavily involved and encourages us to do things like attend conferences, write grants, and become involved in the curriculum writing projects.
>
> Elsewhere in the district the department chairs act like a "filter" and a "roadblock." They will send only some of the notices through to teachers and will definitely stop some proposals for change. A department office gets hundreds of

things--books, brochures, catalogues, and so on--all of it is free. See that bookcase over there? It's great. All of the resources you need. Textbooks, reference volumes, and journals.

Actually, in these other schools the teachers are getting the materials now, too, because the collaborative makes sure these things are sent through the mail.

The hallways are filling with students. The noise from their conversation and the slamming of books and locker doors is nearly deafening. Then the first bell rings, announcing that there are 4 minutes before the first class period begins. Mr. Engle double-checks his desk and the materials he has in his hands and then quickly leads the way to Room 208 for Algebra I. As soon as the students are settled, Mr. Engle begins to cover the math problems at a rapid pace, giving one the impression that there is much content to be covered and that the class has been behind schedule for some time. His patience with slow learners and his tolerance for repetition of each step of the lesson suggest that Mr. Engle cares as much about his students as he does about his subject.

Mr. Engle writes two words on the board: homework and bellwork. For homework the students are to complete "Number 31, items 1-27, odd, p. 182." Mr. Engle flips the switch on an overhead projector and uses a transparency to assign the following problems:

(1) Solve for y.

State the slope and y-intercept of the graph:

$2x + y = 5$

$3x - y = 5$

(2) Solve by the substitution method.

$x = 5y$

$y = 3x + 14$

He refers to this work as the homework curriculum. Bellwork is a strategy that Mr. Engle uses to help gain control of the classroom as soon as possible after the bell rings at the start of class. When the bellwork assignment appears on the screen, students are expected to begin working it. Typically, Mr. Engle's bellwork assignments are closely linked to recent homework and the lesson for the day.

Eight students are seated in the room. As the bell rings, three more students rush in and take their seats, bringing the total to 11. Mr. Engle confers with one of these students at her desk and then returns to his desk at the front of the room. He notices that no one is doing the bellwork and tells the students to "get started on the assignment." Three students begin to work out the problems on their papers. The remainder talk to other students and to themselves, rest their heads on the desk top, or look through their textbook in an idle fashion.

Meanwhile, Mr. Engle takes attendance in his record book and reads notices that were dropped on his desk by students as they entered. The students are scattered all around the room. After class, I asked Mr. Engle about this. He said: "They are sitting where they have been assigned. It's the attendance problem. There are so many students absent that it makes the room look funny, doesn't it?"

Mr. Engle walks into the aisles and looks over the shoulders of those who are working. He says: "Angela, Danny, Kevin, Mary. . . come on. Do the bellwork. You have had some of this recently and have simply forgotten it. There are only a couple of minutes left. Also, I have tonight's homework on the board, here." This prodding helps to get Danny and Kevin started, but

the two girls came into the room talking and continue their discussion now, only more quietly.

Mr. Engle announces that the time is up for the bellwork and asks the students for their answers. This next phase of the classroom routine consists of a check on the bellwork assigned for the day. Mr. Engle asks the students to volunteer to solve each problem. If no one volunteers, he calls on a student who has at least attempted to solve the problem. Always, Mr. Engle proceeds in a step-by-step fashion, frequently echoing a student's words or correcting a student's work. At intervals he will interject a wrong step and ask the class why that step should not be taken. Occasionally, the students answer him.

A student, carrying a duffel bag, enters the classroom, walks to the far side of the room, and sits in a desk. He has said nothing to Mr. Engle and Mr. Engle has said nothing to him. Within a few minutes the newly arrived student pulls his algebra text out of the duffel bag and begins to follow the lesson.

Some students appear to be only partially engaged in the lesson. They talk to one another and distract themselves with personal interests, such as arranging jewelry on their desks, combing hair, examining the contents of their wallets and purses, scratching their faces, doodling, passing notes, talking about car wrecks and insurance, looking in hand mirrors, trading stories about the weekend, and so on. A few students seem to be listening carefully to what Mr. Engle is saying and following his instructions. From time to time, these students will ask him to clarify a point with an example or to repeat what he has said.

Mr. Engle has now walked the class through the first bellwork problem. He puts the line, $2x + y = 5$, on the graph that is etched into the blackboard at the front of the room and says: "That's all there is. The first problem on the test is going to be another graphing problem. You can find all this in section 6.7 of your textbook. You are going to have these terms throughout high school and college."

He proceeds in the same manner to solve the second bellwork problem. Again, he asks for a student volunteer. No one responds. To save time, he solves the problem out loud for the students and then plots the line on the graph. "There," Mr. Engle says when he is finished. "That's really all you have to do." Later, Mr. Engle confesses that he often answers his own questions.

A student raises her hand and asks: "Will we have to know this for the test?"

"Yes, you will see this again on the test," Mr. Engle repeats.

The bellwork check is finished and Mr. Engle picks up the teacher's version of the Algebra I text and points to the board, where last night's homework appears in a column of homework assignments for the whole week. He reminds his students that they have been working on this type of factoring problem for three days. He says: "You should have found out last night that you were doing nothing new." Mr. Engle puts the first homework problem on the board, telling them as he does so that "there will be two of these on your test, like items 16 and 17 on page 180." He solves the first problem in the same manner that he solved the bellwork problems. He inserts errors that he says students commonly make when solving this kind of problem. Mr.

Engle shows how the uncorrect approach fails to solve the problem and then applies the correct procedure.

To solve the remainder of the homework problems, Mr. Engle selects three students at a time to go to the blackboard, and record their problem and solution. Some of the students who have not done the homework attempt to solve the problem at the board. Mr. Engle takes the class through the solution to each problem, correcting students' errors and pointing out other common errors. He does not ridicule, but handles the mistakes of the students, like his own solutions to the problems, in a matter-of-fact manner. Some students follow along in their textbooks and homework papers, others ignore the lesson and talk with their friends, others stare at the wall or sleep.

The door opens again and two female students enter the room. They, too, go to their desks without addressing their teacher. According to Mr. Engle, these students have arrived late for school. Different students arrive late for different classes at all times of the school day, making record keeping a burdensome task and the notion of keeping all students up to date on content a morbid joke among teachers. In addition, Mr. Engle said: "From time to time the principal or counselors will schedule voluntary, special events for some students, making it a legitimate reason for the students to be absent from their classes and frustrating the teacher who is serious about covering the content of mathematics."

The homework check is finished. Mr. Engle tells the students that they will now solve a more complex problem involving factoring by grouping. He has taken the following example problems from the textbook and has written them on a transparency sheet. Mr. Engle uses a manila folder to cover up

the portion of the problem he does not want to show, allowing the overhead projector to magnify this image on the screen:

(1) $3x + 3y$

$3(x + y)$

(2) $4x + 3x$

$(4 + 3)x$

$7x$

He explains each step of the examples. He describes the correct procedure for solving the second problem twice. Then he exposes the more complex example:

$$a(r + t) + b(r + t)$$

$$(a + b)(r + t)$$

Mr. Engle goes more slowly now through each of the steps in the solution of the problem. Then, he uncovers another complex example:

$$3x(x - 4) + 2(x - 4)$$

$$3x + 2(x - 4)$$

As Mr. Engle completes this second example, a student says that she does not understand. Mr. Engle repeats the process again. The student says: "So, that's the answer, right?" Mr. Engle says: "Right, that's the answer."

Mr. Engle produces another transparency sheet and solves three more problems that require factoring by grouping. Then, he puts the last transparency sheet on the screen and tells the students that the author of their text "tried to give them a ringer with this problem."

$$ax + cy + xy + ac$$

$$ax + xy + cy + ac$$

$$x(a + y) + c(a + y)$$

$$(x + c)(a + y)$$

Mr. Engle moves quickly through the sclution of this problem, briefly explaining each of the steps along the way. At the end he says: "See, it was not so bad. Now, use the remainder of the time to get started on your homework for today."

Seven minutes remain in the period. Most of the students spend the time talking with their friends. Two begin to read the page in their text where the assignments appear. One of these takes out his notebook and begins to solve the problems. The other lays down his head and waits for the bell to ring.

Mr. Engle describes each class session as having five phases: bellwork assignment, bellwork check, homework check, homework lesson, homework assignment. He divides up the 40 minute classroom period more or less evenly, allowing approximately 8 minutes for each phase. When the bellwork check goes more quickly, there is more time for each of the subsequent phases. Generally speaking, time not expended during earlier phases is reserved for the homework assignment at the end. From Mr. Engle's viewpoint, this pattern of classroom routine provides evidence that, despite interruptions, absences, and content backlog, he is doing his best to cover the pre-established curriculum and provide time for students to complete their work assignments during the classroom period.

The bell rings, announcing the end of Algebra I and the beginning of the transition to period 3 - 4, when Mr. Engle will teach Consumer Mathematics. He exits with the students and stops in the department office for a moment to pick up materials for the next class. The hallway is like a subway station at rush hour as students walk hurriedly in all directions.

Teaching Mathematics to Urban Youth

Mr. Engle believes that he and the other teachers are not achieving their professional goals. When Mr. Engle reads the Curriculum Standards recently prepared by the National Council of Teachers of Mathematics, he says that it reminds him of the crisis that he and the other teachers face. The Standards are summarized in the following statement:

> The study of mathematics should stimulate and increase our curiosity so that we formulate and solve problems that expand our comprehension and appreciation of the underlying structures of the universe. In the process, we experience the excitement of a challenge, the excitement of success, and the development of a good self-image. (1987, p. iii)

Since the collaborative was established, Mr. Engle has become increasingly aware of the schism that exists between these Standards and the daily experiences of most mathematics teachers. In reference to his previous years of work at North Coast High, he said he would help students pass basic competency tests, provide varied opportunities for students to make up missed assignments and incomplete homework, and offer words of encouragement and guidance about their personal problems. In those earlier years, the chance to explore mathematics was not the driving force of the curriculum.

Asked to talk about his current concept of mathematics and his practice of teaching mathematics in the urban schools, Mr. Engle responded:

> I didn't have much experience with the practical side of mathematics in the earlier days, only what I saw in the textbooks. The

word problems I used were straight out of the textbooks. Those problems are contrived or manufactured by people who don't have experience with different jobs in the real world. You will notice when you look at a textbook that the same problems keep showing up. The kids would get tired of seeing them and I would get tired of using them.

Before the collaborative, teaching mathematics was just a 9 - 3 job. If the students didn't get it, they were "just urban students." Now, we believe we have students who can learn and are able to learn mathematics. It's very important for us to give them the tools in math, so that they can eventually contribute to society.

The students in this Intro Algebra class, for example, have not done well in math in the past, so they are recognized as students who don't do well in math. Most of them don't feel confident in math. Math is conceived as a difficult subject for them. They take it because they have to. To just look at a student, you see a person who doesn't understand why he or she has to take math.

In the urban setting our students have not really been exposed to experiences that they need, not to much at all, really. Also, they have had a narrow approach to learning. Many of them have not been successful before.

Probably it is more difficult to teach here than in a suburban setting. Most teachers would agree that they feel it's more difficult to teach here because of the distractions for

students, their lack of parental support, and that many of them come from single parent families with low income levels. So, they don't have the home experience that the suburban kids are fortunate to have, like support for learning, newspapers, and so on.

After the collaborative got started, I saw a more global view of mathematics in life, in the world. I could see how mathematics could be used by people on a job, how people used it in the real world. This came through symposia, visits to business and industry, and seeing the mathematical problems that are written by people in these areas. In a workshop we wrote word problems, we "Clevelandized" the math problems, meaning we wrote them for our students in Cleveland. The idea is to try to get the students to solve problems in their classes. There is not enough of this going on.

I believe now that we have to show these kids that they can do it and that this knowledge of mathematics will make a difference in their lives. It is a way through teachers to show disadvantaged students how to achieve progress. Because of the collaborative we try to expose them to different things. We try to show them that math, success in math, can open doors to them that have been closed before. They aren't informed about that otherwise.

Mr. Engle believes that his approach to mathematics prior to his collaborative involvement limited both himself and his students. The textbook defined his mathematics and designated the problems his students

would solve. Word problems were artificial and repetitive. His commitment to teaching was weak and his opinion about his students hindered their success. Because of the collaborative, he has expanded his thinking about teaching and mathematics. The process of teaching mathematics to disadvantaged youth has become an important, challenging aspect of his work. He sees the problems they bring to school in a different light: They need help in mathematics and he is there to provide it. In addition to the progress he has made in terms of content and his methods of teaching mathematics, he has acquired a deep, professional commitment to his work.

Mr. Engle is well aware of the origins of the problems he experiences as a mathematics teacher in inner-city Cleveland. Asked to explain what he perceived to be the major problems influencing his work, he listed three: history of "home" abuse, chronic absenteeism, and the performance and commitment of professional staff.

History of "Home" Abuse. Mr. Engle's view of urban families was:

> Don't get me wrong on this. It is not that all of our kids come from bad homes, but too many of them do. These kids live in the city, not the suburbs. Sometimes the only stability that they have is school. It's the only safe place that they have. We have to create a learning atmosphere that has not been present in their lives.
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> The hardest problem I have to deal with is kids who come from abusive homes, dysfunctional families, and so on. Too many of the parents are chemically dependent on drugs and alcohol. And what are you going to do when the mothers' boyfriends are sleeping with their daughters and abusing their sons? These kids come to school

and get into trouble. They can't sit here and not have trouble concentrating.

I try to help them with some of the classroom policies I use. For example, I will stand at the doorway at the start of class and greet them and look carefully at each student who enters. I look to see if they are OK. I also want to know if they have brought their materials to class. If they have, I let them know and, if they haven't, I tell them, too.

There are some kids in my classes who have a tendency to blow up in class. Something that happens will set them off. I've had to get physical at times, but I've never hit a kid. That's wrong. And it's rare that I'll throw a kid out. I can usually restore order by using my voice and reminding them of the rules for classroom conduct. But you can't have four kids in every class who make it impossible for you to teach. So, how do you teach percents in a situation like that? Many of these kids can't concentrate because of what else is going on in their lives. The abusive treatment that some teenagers have received in their homes not only causes them to have difficulty concentrating in school, it predisposes them to treat others in dysfunctional or oppositional ways. Teachers must watch for any indication that a student is ready to "blow up," to hurt himself or herself, or other students in the classroom.

Mr. Engle told me that he frequently feels torn when addressing his classes. In front of him will be a student who is interested in what he is saying about mathematics. But in the next row, another will be "doing everything imaginable to destroy the chances that anyone will learn." Mr.

Engle recognizes that it is unfair to allow one student to disrupt the process such that another student is denied the opportunity to learn; at the same time, he recognizes that the disruptive youth "is getting beat up in his home or has no food to eat, or never has known a responsible mother or father." This schoolteacher's perspective embodies sensitive understanding and a deep sense of empathy for his disadvantaged students.

The violence so common in some of the homes and streets of the community comes into the school and influences the mathematics curriculum. Mr. Engle reports that his teaching practices take into account that many youths are socially unprepared, sometimes dangerously so, for a lesson that involves peer-group participation, where the actions of students are less likely to be under the direct and watchful eye of their teacher. The design of student desks, gridiron seating pattern, rigid schedule, and adherence to a structured, pre-established curriculum provide additional controls for the conduct of teaching and learning.

Chronic Absenteeism. According to Mr. Engle, the abusive treatment that some students receive at home and their absence from school are closely related. It is not uncommon for a student to be absent from school after he or she has been the victim of serious, abusive treatment, sometimes self-inflicted. Some parents sanction absenteeism, some cause it. Students commonly watch for opportunities to skip school, such as when their parents hold night jobs and sleep during the day. In many instances, there is no one in the home to check and see whether the youth went to school. Mr. Engle explains:

> A second major problem with teaching is low attendance and the baggage you get with that. Here, look at my record book. On

any day of the week I'll have half or more of the class missing. Look at all of those X's marking absence. It would be one thing if the same students were absent all of the time, but it is different students cutting class or school all of the time. They miss the lecture; they miss the test; they don't do the homework.

How is a teacher to know that the students have learned anything? Then, there are the kids who come into class late. You saw that today in Algebra I.

Take a look at the comments on these homework papers. If they haven't done the homework, I require the students to turn in a sheet of paper anyway with their name and an excuse. Read these: "I was absent , I was absent, I was absent, I forgot my book, I left my book in school, I forgot it, I forgot it at home, I was late and forgot my book, I don't have it, I left my book in my locker, Someone took my folder with my homework in it."

Only five students did the homework I assigned yesterday, which consisted of eight problems involving subtraction and six problems involving multiplication. One of these students completed the eight subtraction problems and wrote up the multiplication problems, but didn't finish, and wrote at the top of the paper: "Homework: Did not finish." Only two students of the five who did the work actually completed all of the problems. One of these got 100 percent. The other had most of the problems wrong. Of the other three who attempted the work, two got correct answers to most problems they attempted. One had numerous errors.

What is a teacher to do when there is so much homework missing and so much so wrong? And here, look at this paper. This student writes: "I forgot to do it." How could he forget? He wasn't even here to get it.

Another aspect of this attendance problem is kids coming in all of the time to get something they forgot. For example, one of the girls came back to class this afternoon because she forgot her purse. A boy came in here demanding that I give him back his Class and Hall Absence Record. I told him I didn't have it, but he didn't believe me. We had an argument over this, right in the middle of my class. I have no idea where the sheet is. I told him to leave the room. But it was too late, the class had been disrupted. It takes five to ten minutes to get the class back on track.

The national issue of dropouts assumes new urgency when viewed from the perspective of an inner-city teacher. It is not surprising to Mr. Engle that half of the students in Cleveland do not graduate. Many of these students are absent from school at least half of the school year. The teacher must ask: Who will be gone? When? Why? What will be done with the content? Mr. Engle's questions form the basis of a complex problem of abuse and absence. "This is a traditional high school, but these are not traditional students," he says.

Mr. Engle explains that many of his students leave school at 2:15 p.m. and do not or cannot do mathematics until they return to class the next day. Some students lack interest and initiative. Others find little or no support for schooling in their homes. Some may live in dysfunctional

families and receive abusive treatment at home. Many others come from families with long histories of enduring economic and educational disadvantage.

The homework curriculum helps students to complete their requirements in mathematics. It provides a balance of directed instruction and study time to allow students to complete their lessons during the mathematics class itself. The homework curriculum is Mr. Engle's response to the exigencies of schooling for disadvantaged youth, the most influential of which are abuse at home and chronic absenteeism.

Performance and Commitment of Professional Staff. Urban students bring problems to the Cleveland public schools that influence the work of the mathematics teacher in serious and explicit ways. The homework curriculum is a functional response to these problems. As Mr. Engle points out, differences also exist in the performance and commitment of professional staff--differences that interfere with the teacher's efforts to help students learn mathematics:

> The third area I think has an effect on the teacher's work is the kind of support that comes from the principal and the other teachers in the building. The collaborative has been very helpful in relieving both of those problems at North Coast High School. Since the collaborative, I've seen a change in the commitment around here. We have six full-time math teachers and they are heavily involved. We share our ideas about teaching, work out problems we may have with the principal's decisions, and get plenty of encouragement and support from our department chairperson.

Because of the collaborative we have found new ways to approach the teaching of mathematics. We have more available to us as teachers that we can share with the students. We are accumulating great amounts of practical experience, problem-solving strategies, and teaching techniques. We are now able to try these things because we have support. In the past there was no support here. In other places, like the junior high schools, where only two or three teachers are involved with teaching mathematics, it's different.

This kind of commitment is not due to a reduction in class size or an increase in salary. It was support that we needed and it couldn't come in those simplistic solutions. It was by showing that we are professionals and that we have something very important that we are doing, that we are teaching our students mathematics, that it is a very important thing that we are doing. It follows that teachers need to feel that they are contributing and that it does matter. The collaborative has shown us that it does. A belief system has been created about the work that we do and the students we work with that makes a difference in the lives of both.

There are problems in some of the other high schools, though. For example, in one school the teachers report that their principal has strange behavior. He never looks at you when he speaks and doesn't listen to what you have to say. He will come down to your room one day and charge you with responsibility for something you didn't do or that isn't wrong.

For instance, he hollered at a teacher for the graffiti that students scribbled on the walls and lockers. How can a teacher know that a student is out in the hall writing on the walls? They can't monitor the hallways when they are in class teaching. That's the principal's job. In another instance he jumped on a teacher because she had students lined up waiting to get in her room during class change time. She was greeting them and checking to see that the students had their materials. What's wrong with that? This particular principal is like that all the time.

The way principals treat their faculty is an issue that comes up all the time at Teacher Advisory Board meetings. In some of the buildings the teachers are getting "beat up on" by their principals for not getting high enough achievement results in their classes. Teachers are being blamed for the failure of students to learn, when everybody knows that the abuses and attendance records are to blame. The students aren't there half of the time. If they don't come to school, we can't teach them mathematics. We can't get them caught up.

There are schools where the principals publish the grades and use the number of F's as an indication of poor teaching. These teachers are getting beat up on continually. Some of them feel so much pressure against failing students that they will give passing grades just for attendance. They can't afford to lose their jobs. Not all principals are this bad, but there are enough poor ones to make work difficult or unpleasant for many of our mathematics teachers.

Not all of the department chairs are good. They can have policies that just don't work very well. For instance, they won't let anybody use department materials after school. You have to check them out before 7:30 a.m. and check them in before 2:30 p.m. Or, they operate a dead letter office. Whatever comes to the department goes there. If they don't want to send it on, then nobody knows it came in. I've never heard of a department chair being replaced. Once they get in there they are there and they get stale. They can be there until they retire. If they are good, fine. If they are not, then you have problems.

Most teachers feel enough pressure as it is. Teaching is a stressful job. When you add the competencies, it's ten times worse. If we don't get to the particular competency in class, then when the students from our class take the standardized test, they will fail the item and we are responsible because there was no coverage of that item in the class. But you can't teach them mathematics unless they are in class. They will come back after a couple of days of absence and be in the clouds.

Parents are also part of the problem. Some of them are so young and are themselves so poor academically, that they can't help the kids and actually hinder our chances of helping them. The parents will actually make their kids stay at home and miss school to take care of a baby sister or brother or work some job until 3 a.m.

Some teachers have all but given up and require students to read aloud from the textbook every day. Word by word, page by

page. Every day they go a little further in the book. That way there is nothing missed that is required. An excuse heard from the students is that the teacher doesn't stimulate the students, that he is a boring person in class. We have some others whose classroom practice is wrong because it hurts students. For example, a teacher will use embarrassment to keep students in line. He might say something to make fun of the student or the student's family. He may think it's funny, but the students don't.

Mr. Engle's observations about the principals, department chairpersons, and his colleagues illustrate the differences of perspective and commitment held by various schools' professional staffs. Involvement in the collaborative, appears to foster a high level of commitment to the occupation of teaching and a high quality performance in the classroom. The building-level administrator plays an important role in creating a school environment that promotes effective teaching. When this key individual has poor public relations skills and relies on threatening or demeaning practices, teachers' morale will be low and their levels of alienation or fear will be high. It is Mr. Engle's contention that either condition results in a quality of professional life for teachers that, ultimately, contradicts the aims of the school.

The department chairperson stands at the lowest level in the school hierarchy and acts as an advocate for the mathematics department, making sure that teachers receive whatever benefits are available from the formal organization. Mr. Engle believes that his department has a nearly ideal person in this position. His (:terization of the department

chairpersons in other schools creates a picture of negligence and obstruction. The worst circumstance for a teacher would be a school in which both the principal and the department chairperson lack essential skills for personal relations and leadership. Mr. Engle expresses concern about the district's criteria and process for choosing and retaining ineffective people in these positions.

The inadequate and unprofessional conduct of some of his colleagues was a difficult topic for Mr. Engle to discuss; he acknowledged that he recognized his own potential to become a burned-out teacher. His reluctance also was due in part to a sense of frustration with a professional structure that keeps teachers in relative isolation from their peers and in near continuous contact with difficult adolescents. While he did not excuse poor practice among teachers, he did identify with his peers and understood how they had finally succumbed to the daily pressures of teaching. In Mr. Engle's opinion, the practice of teaching should not bore students--although there will be tiresome routines--and it should never hurt them. To the extent that the teacher finds "joy in this work," the students will know the challenge and benefits of learning mathematics.

The Collaborative Project. For Mr. Engle, the problems associated with the district and the people who work in it cannot be wished away nor avoided for very long. He believes that the district must continue to honor its commitment to integrate the schools, that the school board and central administration must provide continuity and integrity in leadership, and that the district's mathematics teachers must become actively involved in the reform of the school curriculum. These convictions are based upon his own broad personal experience, his faith in the individual, and his commitment

to collective work. Today, Mr. Engle says he has access to a source of very meaningful support, which he and his colleagues proudly refer to as the C^2ME.

What you see in the Collaborative is a concern for dealing with the teachers' problems, at least as they involve the teaching of mathematics in the Cleveland City Schools. Of course, the C^2ME can't solve them all at once, but we use the meetings, resource center, conferences, and grants to make the improvements that we need. When we sit on the Advisory Board, we are there with influential people from this community, leaders in business and industry, who want to do something about changing the schools in Cleveland.

The Mathematics Teachers Resource Center has equipment and materials available for the teachers to use. We wouldn't have this stuff otherwise. Look at the quality of our tests, for example. They used to be sloppy, handwritten, you know the kind. Now they are neat, so that everybody can read them. We use the computer and printer to make certificates, newsletters, and so on.

The Resource Center is also a place to come to and talk shop with another teacher. You see teachers come in here and sit down for an hour or more to talk about some plan for teaching they came up with or something they did with their students. They come here to search for ideas among all of these materials.

In a sense, you might say that the collaborative is for the burned-out teacher, who comes here to get revived. We bought this software, got this equipment, held grade book workshops, and got

teachers involved in writing standardized tests. As a result of involvement in this group, you help make decisions. That creates a real opportunity for rejuvenation.

There are teachers who are reluctant to become involved in the Collaborative because many of them have had the rug pulled out from under them many, many times before. Now, as the word gets around, they will begin to note that it is something that is going to be here and that it can help them. We have a core group of teachers here that is involved in everything. It's the marginal teachers who will hesitate to get interested in the Collaborative.

I think the Collaborative has really helped us in that it has made teachers feel better about themselves. The teachers begin to feel down about their subject matter specialization because so many students are beaten down every day by the math. As a teacher you begin to feel bad because you are awarding so many bad grades. Cleveland City School students have a low self-concept in regard to mathematics. When you present them with a word problem, they immediately decide that they can't do it, even though it may be simple. Or, maybe, I'll give them some problems and one of them will have a fraction in it. They will say right out that they can't do that one.

Five years ago you couldn't get permission for a professional leave. You had to take a sick day. You had to lie. The professional day was supposed to be used only for something in your area and was approved of only by the administration. The administration might decide that professional development consists

of sitting around and reading the desegregation order. That's demeaning. The in-service sessions were made up of garbage. You had no hand in helping to decide what is going to be of value to you as a professional.

Now, a major point for all of us is the chance to work on our professional development ourselves. We are able to expose ourselves to situations that we haven't had in the past. For instance, conferences where we meet with people who run businesses, workshops on the use of calculators and computers, setting aside time at the meetings to talk with teachers in our system, talking about common goals and problems with people in the university and in business and industry.

A lot of teachers have said that they really appreciate the fact that we get to meet and talk on the same level with college professors and mathematicians in business They feel as teachers to be a part of that whole spectrum of mathematics and its application in the world. So, more or less, we are on even terms with these two groups, whereas in the past we have felt that we were below them.

There are times when it seems that in the Teacher Advisory Board meetings all we do is exchange war stories. We do. But it's important to hear what's happening across town. The situation is pretty bad in some of the schools where my colleagues teach.

The collaborative has brought teachers together on the problem of teaching mathematics. For years I had not met the

teachers who taught at these other schools. Now we see each other at workshops, conferences, dinners, and so on. We talk about the different ideas we have, about the problems we have that are the same, and how we are going to deal with them. We could never go to a lot of these conferences, if we let the school system decide what's important. This teaming up has led to all of us taking some pride in our work, some pride in the C^2ME.

Too often, the teachers were closing their doors and closing everything else out. They would be there in their classrooms, isolated by themselves. So many of the teachers who have been in this system have never been treated as professionals by the school board, by the administration. They are in the classroom on a day-to-day basis and are left out of the decision-making process. It shouldn't be that way.

There are so many things that you can share - I learn when you go to work with colleagues. The value of team work is something that we learn in the internships with business and industry We know the value of it from serving on the Advisory Board. The collaborative has helped teachers do things together, with the support of other teachers and other professionals, instead of always doing things alone. We are all working together on the same thing: how to offer a better education to the students in Cleveland. That is one good result.

When Mr. Engle speaks of the collaborative, the tone of his voice and the choice of his words indicate a deep sense of pride of ownership and respect for collective, mutually beneficial decision making. He serves on the

Advisory Board as a representative of the mathematics teachers, providing an educator's perspective to help guide discussions, policy making, and the approval or renewal of proposals. "For once in my career," he says, "I know what it means to have responsibility for the development of an educational program." The success or failure of the collaborative project is critically dependent upon the participation and efforts of Mr. Engle and his teaching colleagues.

The collaborative imparts a sense of relief to teachers that does not inhere an escape from work or responsibility. Indeed, as Mr. Engle points out, teachers come to the Mathematics Resource Center and to the other C^2ME functions to rejuvenate themselves, to replace "tired blood." Involvement in the collaborative triggers a proportional increase in demands on a teacher's time and energy. The result for teachers is knowing that they are doing a better job and feeling satisfied that their efforts will result eventually in a higher quality of curriculum and instruction in mathematics.

From the point of view of teachers such as Mr. Engle, the official, formal organization of the school district fails to recognize or appreciate the needs of teachers. Articles and editorials that criticize the city schools appear regularly in the Cleveland Plain Dealer. These statements frequently argue that the central office administrators and school board members are enthralled by big city politics and public money. At school board meetings and in letters to the editor, influential members of the community often express the belief that too many school leaders have abandoned the real and immediate educational issues surrounding teaching and learning in this public school system. As Mr. Engle's statements make clear, it is not uncommon for both the principal and department chairperson

in a single school to lack effective leadership skills. At the classroom level, uninspired teachers succumb to burn-out. In view of these problems, Mr. Engle sees the Collaborative operating on a district-wide basis as an ideal department for the city's mathematics teachers.

III. ISSUES AND CONCERNS

Preceding sections emphasized one teacher's classroom practices and perceptions about C^2ME. It was my intent to offer an accurate representation of the teacher's work and to use his own words to present his perspective on this work. The result involves an abstraction from the actual situation.

In this section I discuss three themes suggested by the data: systematic management and technique, the homework curriculum, and the ideal department chair. If the Cleveland City School teachers plan to reorganize the mathematics curriculum in substantive ways, then this interpretation may provide some guidance for new directions.

Systematic Management and Technique:

The role of a mathematics teacher such as Mr. Engle is to assist the district administration in implementing the policy and practice of standardized, explicit teaching for systematic, competency-based instruction in mathematics. The teaching method, classroom rules, and curricular materials have been standardized in order to allow a routine style of presentation across all classrooms and an explicit, ordered mathematics curriculum.

A textbook is the mainstay for the district's mathematics instruction. Problems for instruction, bellwork, and homework are chosen from the textbook, and the directed lessons presented by teachers generally follow the textbook. In some instances, the lesson consists of students reading word by word from the book.

Problem solving is taught by guiding students through word problems based on real-life situations. Mr. Engle usually chooses a problem from the textbook, clarifies the problem for his students during class, challenges the students to solve it during a question-and-answer session, guides their work toward particular solutions, and helps illustrate the answer. Generally speaking, Mr. Engle relies upon the textbook for problem solving in his mathematics class. When a new textbook is purchased, it is sometimes necessary for him to revise the course of study to maintain correspondence between the text and the specific objectives of the curriculum guide. He works at limiting his reliance upon the text book.

Through classroom instruction, bellwork, and homework, the students practice solving the kinds of problems that may appear on the standardized mathematics tests. According to Mr. Engle, the policies of some principals--including public display of failure grades and use of student achievement as an index of effective teaching--tend to alienate and intimidate teachers, encouraging some to adopt a practice known as "teaching to the test." The algebra and geometry competition is an exclusive contest for Cleveland students and serves as a high level mastery test for competencies in mathematics. The students tend to do well in the contests, but sometimes express discouragement about items on which they have had no practice.

The systematic management and routinized techniques of the competency-based mathematics program seem to allow Mr. Engle little room for deviation from established content and practice. The explicit nature of the content and the characteristics of his students lead him to rely on directed or explicit teaching as the safest and surest method of instruction. Mr. Engle knows that the objective-based curriculum contributes to a definition of good teaching as that which is directed toward an explicit, pre-established objective. He vows that, given the goals and objectives of the district, he could do his "best" work for the system by teaching to the test. Although it is tempting at times, Mr. Engle chooses not to do so because he believes that teaching to the test is bad practice.

Homework Curriculum

It was characteristic of Mr. Engle to follow a regularized format when conducting his classes. This routine, which he called "the homework curriculum," consisted of five phases: bellwork assignment, bellwork check, homework check, homework lesson, and homework assignment. This curriculum was characterized by directed lessons with coverage of content held to the minimum. Four factors account for Mr. Engle's dependence on this routine: low achievement records of students, high absenteeism, discipline problems, and the popular belief that teachers are accountable for students' learning. The homework curriculum helps students learn mathematics, but it raises some questions: What kind of mathematics is this? How much math? How is it learned?

This homework curriculum is the product of the system's adjustment to the unique characteristics of its students. Prior to the desegregation

order, Mr. Engle said, he could assign homework and assume that 90 percent of the students would complete the problems without question and with good results; the remaining 10 percent consistently forgot or chose not to do the assignments. Still, homework consisted of an assignment given to students to be completed outside of class. The more adept or motivated students would view the problems assigned for homework as a minimum and search for greater challenges later in the text.

In the years since the desegregation order, Mr. Engle has recognized that many of his students have the potential to do good work, but it has consistently been the case that only 10 percent of the students turn in assignments; and 90 percent do not. This has been true even when students know that the problems they have been assigned as homework are all that they will cover during the next day's class.

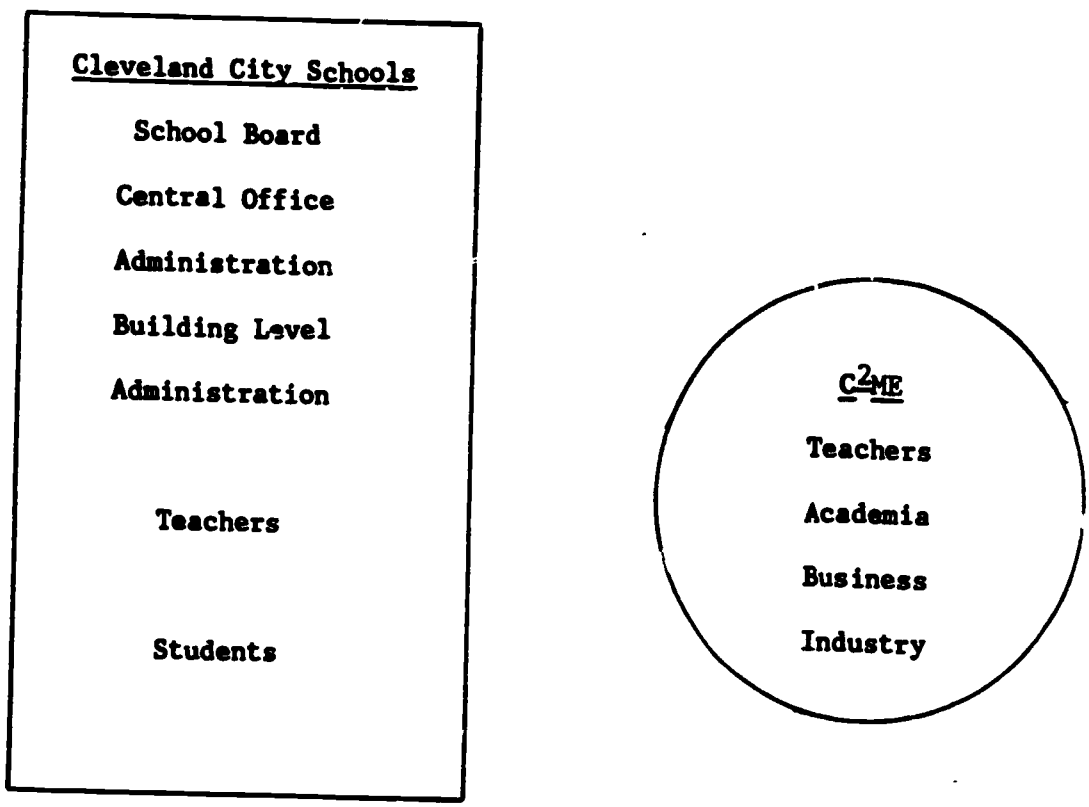
The definition of homework has changed--for Mr. Engle and for his students. Homework <u>is</u> the mathematics lesson. The problems assigned each day represent the maximum that can be covered during the homework review session held the following day. During each class period, Mr. Engle introduces the homework assignment for the following day, and so on. The problems assigned for bellwork extend the homework assignment for a particular day and keep the students busy while Mr. Engle is preparing for class. Thus, the teacher and students proceed day by day through the mathematics curriculum.

<u>Ideal Department Chair</u>

The C^2ME functions as an abstract, ideal department chair for the entire mathematics faculty in the Cleveland Public Schools. The teachers view the collaborative as a neutral but effective, formal, in-house

professional organization. They believe that the grants, symposia, and conferences sponsored by the collaborative are basic amenities that should be available to all professional staff at all times, but the reality is that, without the collaborative, these options do not exist for Cleveland's inner-city teachers. Today, these teachers rely on the collaborative to rejuvenate their professional attitudes, knowledge, and skills in mathematics instruction.

This diagram represents the relationship of the collaborative to the administration and the school board:



In the rectangle are the organizational elements of the school system, which relies exclusively upon the hierarchical, top-down model for decision making. The mathematics teachers view the collaborative as a formal, professional organization that functions outside of the formal hierarchy of

the district. In the diagram circle are the various elements of the collaborative. Teachers view the benefits available to them through the collaborative as a necessary and valuable prerequisite to their professional development and to the improvement of mathematics education for urban youth. Relations between the collaborative and the school system have been cordial; the newly hired superintendent has endorsed the project and its goals.

Mr. Engle suggested that the department chairs in some schools support the collaborative, while in other schools they play an obstructionist role. He characterized building-level principals in much the same way. In all cases, however, he saw the collaborative as a supernumerary department chair for all mathematics teachers.

Asked to comment on the operation of the collaborative and its official concept of mathematics, Mr. Engle explained:

> First of all, I don't think there can be a single, official idea because of the three groups in the collaborative. Rather, we are leading ourselves in terms of an idea about mathematics for disadvantaged students in this system and the idea gets translated into practice in the board room and the classroom.
>
> On our Advisory Board we have a mixture of people, and that is where we may have differences of concepts. On the one hand, we have the university professors, who have beliefs from the past that we were not doing as effective a job in teaching mathematics as we should have. So they have been on the Board to see that we prepare students for college.
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> Second, we have business people on the Board, whose main interest is in seeing that we prepare students for the work force.

And their idea of mathematics is practical application, so that the students are able to adapt to different situations.

Third, we have teachers who see the existing concept of math as one which the students are not quite capable of meeting, that the expectations of the official concept of math, as it is perceived by the other two groups, is too high for many of our students.

What we three try to do is to create situations so that all of our goals and expectations are met, eventually. That is a difficult task--getting these different people to come together and talk about reality and official concepts.

During Advisory Board meetings, the teachers engage in deliberations with leaders from business and industry and from the university. Each of the subgroups has a unique viewpoint in regard to the mathematics education of Cleveland's high school students. As a result of their regular meetings, however, a shared concept of mathematics is gradually and continually being constructed. Mr. Engle's remarks suggest that he and his school colleagues welcome and respect the positions of the other two groups and are pleased to know that their own contributions as teachers are welcome and respected.

The collaborative enables Mr. Engle to participate openly and honestly in a decision-making process involving the mathematics curriculum. Without the collaborative, according to Mr. Engle, "we had to lie about what we were going to do on a day we wanted to be out of the classroom, and here we were just wanting to attend a math conference." In his opinion, the full empowerment and professionalization of mathematics teachers depend upon their movement as a cohesive group into an informed and active position

relative to school policy and curriculum and instruction, at least as these pertain to mathematics.

Like school districts elsewhere in the nation, the mathematics curriculum in the Cleveland City Schools is based on the production metaphor (Kliebard, [1972], a programming model borrowed from business and industry). The achievement records of students, the characteristics of disadvantaged youth, and the work schedules of teachers contribute to the maintenance of a structured, baseline curriculum, insuring that, at the very least, students will complete their homework assignments in mathematics.

Mr. Engle and other teachers on the Advisory Board are considering and proposing new directions for their mathematics curriculum. Chief among their concerns are enrichment of the curriculum, improvement of attendance, and use of calculators and computers in the classroom. The collaborative reports that some progress is being made in each of these areas. The attitudes and perceptions expressed by Mr. Engle suggest that the collaborative is a large umbrella under which he and other mathematics teachers find support for professional activities and relief from some of the more repressive features of the system.

Summary

In this report I introduced a character, Mr. James Engle, to present the view of a mathematics teacher who has a strong commitment to his work as a teacher and to protecting the personal and educational interests of disadvantaged students. We examined his curriculum and routines for classroom instruction and found that he is doing effective work, despite his own insistence that he has higher expectations for himself and his students.

He attributes the lower-than-expected achievement records of his students to conditions in their home, community, and school.

Mr. Engle speaks with pride about the collaborative, known as the C^2ME, and he has good reason to do so. It has been the policy and practice of the collaborative to emphasize the needs of mathematics teachers, with particular attention to their involvement in all of its operations. Mr. Engle believes that his position on the Advisory Board is an important factor in his educational practice and is symbolic of the best direction for urban educational reform.

For too long, Mr. Engle maintains, teachers have been content to allow persons with little or no understanding of teaching and learning to make unilateral decisions about the education of children and youth in the urban public schools. What the collaborative has shown is that the classroom teacher brings a critical perspective to the board where decisions are made concerning educational policy and practice. The collaborative's next step entails proactive involvement with the revision of a mathematics curriculum and reorganization of the urban school system to promote a democratic life for all who work there.

Appendix

The Method of Research

The main objectives of this research were to find out how mathematics teachers do their work in the Cleveland City Schools and what they think about doing mathematics, particularly in reference to the Collaborative Project. The accompanying report is a product of the field study I conducted in the spring of 1988. To do this work I relied on standard ethnographic techniques of participant observation and interview. The perspective I took on the situation is called natural history. This means I tried to interfere as little as possible with the events unfolding naturally in the setting, while recording concrete and historical descriptions of persons and pertinent events in their lives.

The focus for this research was on a wide range of interests. I looked at teachers, mathematics classes, student life, principals, Advisory Board meetings, Teacher Advisory Board meetings, Mathematics Teachers Resource Center, and collaborative functions. The breadth of exposure in the relatively short period of time (four months) led to a rich accumulation of data. The different persons who volunteered to serve as participants deserve credit for the depth to which I went in any particular aspect of the investigation. Eventually, I settled on one character to present the views of a real teacher in the Collaborative. I called him Mr. Engle.

The officials of the Cleveland Education Fund, teachers, and school officials of the Cleveland City Schools gave consent willingly for me to pursue the various and often uncertain avenues of the study. I am grateful for their assistance and patience. There were days when the interviews kept

people long past their usual times for departure from the office or school. Also, the things a researcher will focus on tend to be mundane, redundant, sensitive, and so on. Throughout these trials the participants remained helpful, willing to tell their story.

The name and specific designation of the public school (North Coast High School) are fictitious. Distinctive features that would lead to easy recognition have been disguised. Common characteristics gathered in visits to four schools have been mixed with outstanding features in order to create a realistic impression in one example of the Cleveland city high schools.

A typical day for me in the field included some time devoted to gathering detail through observation and interview about the setting, school building, students, principal, and mathematics department chairperson. More time was spent in the field conducting the observations and interviews with mathematics teachers. In some schools only one teacher provided me with information about the Collaborative. In other instances several teachers from a building became involved in the study.

Interviews consisted of two kinds of questions: general and specific. General questions addressed in a broad, leading way the problem of teaching and the benefits of the collaborative. Here are two examples: How would you describe the Mathematics Teachers Resource Center? What does the Collaborative mean to you? Specific questions were often derived from answers that participants gave to the general questions.

Sometimes the data from observations suggested specific questions for an interview. For example, I asked a teacher why he used a textbook after observing his class. In another instance I asked a teacher to describe her work and that of her colleagues before the Collaborative was formed. The

answers from these questions usually led back to the more general questions. Instead of structured protocols, the interviews for this investigation were spontaneous and focused events.

Sustained observations were made of teachers conducting mathematics classes at different times of the day and week. A day was spent as a student, giving me a perspective that crossed the different content areas and varieties of student life in high school. Frequently, the observations and interviews became combined research events.

The stages I used for handling data are these: recording, transcribing, editing, searching for key terms, posing hypotheses, testing hypotheses, building categories, testing categories, and searching for themes. I relied upon these routines to gather and analyze field study data. They were not followed in a linear fashion, but rather expediently and openendedly. I tried to let the research process unfold as much as possible as a response to opportunities afforded by particular situations.

The basic research question was this: What is going on here? From that point on I was dependent upon the good will of the participants, some basic recording skills, and my own ingenuity. "Teachers on the Board" is an attempt to express what the Mathematics Collaborative means to the men and women who made it in Cleveland, Ohio.

References

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