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(Author/YP)

Routines and Mathematics Curriculum Reform

by

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ABSTRACT

This article presents ethnographic research of a project funded by the National Science Foundation to support the Cleveland teachers' efforts to meet the new standards for mathematics and to empower themselves to make decision.; about curriculum. The author illustrates the manner and extent to which the teachers became engaged in the effort to reform mathematics instruction for urban youth. The teachers had established a collaborative organization concerned with planning for problem-solving in mathematics. They met on a regular basis during the first year, cooperatively solved problems, and conducted pilot studies of the eff ects of problem-solving on their students. Despite these effects, however, curriculum reform and teacher empowerment remained catch phrases only. In its first year of operation, the project's tacit function was to offer the teachers relief from the institution. The teachers' informal routines are seen as coping mechanisms. Unfortunately, because of institutional conditions, the teachers' limited concept of curriculum theory, and the tendency for teachers to focus on mechanical or less-than-significant concerns, business-as-usual continued to dominate the educational program.

Routines and Mathematics Curriculum Reform

Introduction

A prerequisite for success in virtually every occupation today is a sophisticated ability to solve problems in mathematics. At the time when our nation's technology offers its citizens the greatest promise for humane and exciting occupations, the youth who could most benefit have serious academic deficiencies.[1] The children in Cleveland's public schools, like urban youth across the nation, come from poor families, many of which are dysfunctional, most of which are minorities with long histories of disadvantage. These urban children have high absenteeism, poor academic achievement, and drop out rates near or exceeding 50 percent. Not only are their chances for gainful employment diminishing--their hopes for a good life are vanishing.[2]

In recognition of this condition, Cleveland's math teachers received a grant from the National Science Foundation in 1988 to reform the teaching of problem-solving. Its primary purpose was to enhance the mathematics curriculum for intermediate level urban students. Through meetings, lectures, workshops, and demonstrations the intermediate level math teachers would reorganize the math curriculum, giving special emphasis to improving the problem-solving ability of their students. The project would test the effectiveness of the math program through pilot projects, leading to revision of problems. Two important, underlying motives of the project--to meet the new standards for school mathematics and to empower the teachers to make decisions about curriculum--identify it with "the second wave" of school reform.[3]

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METHOD

This article describes what was called, the "Problem-Solving Infusion Project," and shows its effects on the teachers' work as a result of its first year of operation. The study used ethnographic methods, chiefly, recording descriptive and historical data gathered from observations and interviews with the curriculum writer, teachers, students, Curriculum Director, and Project Director. The field work focused on the natural history of this curriculum reform effort,[4] during a six month period of time from January through July 1989. The researcher documented the following two areas (1) the extent to which the math teachers adopted a collaborative style of planning, and (2) the extent to which they also became knowledgeable and skilled in curriculum planning and teaching for problem-solving in mathematics.

The results indicate that the curriculum writer and intermediate level mathematics teachers established a collaborative organization concerned with curriculum planning. They met on a regular basis during the first year of the grant, cooperatively solved math problems, and conducted pilot studies of the effects of problem-solving on their students. Thus, to some extent the teachers engaged themselves in a mathematics curriculum reform effort.

However, numerous articles and editorials in the city's major daily newspaper, The Plain Dealer, made it clear that the Cleveland Public School District--like many other metropolitan school systems in America--was in desperate straits.[5] Indeed, the school board was like a window on Cleveland, revealing the city's struggle to reestablish itself after decades of educational decline and to remedy inequities of race and class within the school system.[6] School board members quarrelled with one another, engaged in grandstanding, and regularly threatened the superintendent with dismissal.

During the decade preceding the study, teachers had voted to strike five times, several superintendents had resigned or were fired, and one committed suicide. These events imposed upon the school district an unwieldly, bureaucratic, and excessively politicized organization. Its emphasis on hierarchical decision making, rigid scheduling, and rule-bound operations made it, to a great extent, unresponsive to teachers and students. Compliance with court-ordered desegregation and lowering the 50 percent dropout rate were two longstanding issues which divided and frustrated citizens and educators alike.

The following three critical issues impede further development of the problem-solving project. Lack of a curriculum theory leads to unguided practice and over-dependence on the Course of Study. The behaviors of some participants, seen as routines' that originate from the institution, waste resources, hinder progress, and foster frustration. The social and political turmoil of a metropolitan area in the midst of its own reconstruction, both masks and dwarfs the equally important problems of urban school reform.' In the light of these issues, the teachers--at the end of the project's first year--face some important crises and contradictions regarding their effort to reform the math curriculum and empower themselves. Considering occupational research, generally, and educational research, particularly, these results are neither surprising nor are they insurmountable.' This report is intended to clarify further, the issues common to curriculum reform and to promote teacher empowerment.

The findings are presented chiefly from the perspectives of Mr. Maxwell Meder, the curriculum writer, and Ms. Eunice Senter, a teacher. These are pseudonyms for the project's real participants. Emphasis is given to presenting their views in a full and accurate manner. The presentation begins

with Mr. Meder's explanation of his involvement with the project, including a description of his work with the teachers, an expression of his concerns, and some remarks from the Curriculum Director. Then, there is a description of the problem-solving committee at work. Three characteristic patterns of teacher behavior are identified. Interestingly, the latter two, while very apparent, contribute little or nothing to the project: practice on the work sheets, shop talk, and grousing. The next section presents Ms. Senter's view of the Problem-Solving Infusion Project: instead of being a curriculum reform effort, the project functions tacitly as a relief mechanism for teachers. Finally, there is a discussion of a variety of analysis-suggested themes that help to interpret the project's effects thus far. The article closes with some comments on these effects as well as some suggestions for addressing the negative aspects of "second wave" reform.

MR. MAXWELL MEDER, THE CURRICULUM WRITER, SPEAKS

The Curriculum Writer for the Problem-Solving Infusion Project, Mr. Meder, was a high school mathematics teacher at an outlying school district. He had 23 years experience in teaching and curriculum development in urban, suburban, and small town settings. In the statement to follow, Mr. Meder describes how the group started, discusses the operating ideas of the curriculum writing project, the activities of meetings, and some concerns about the results of their work. Mr. Maxwell Meder speaks.

Getting Started

There was a kick-off dinner in November to announce this project to the intermediate level math teachers, who would eventually use all the materials. About 32 out of 85 came to the dinner. From that original 32 we got a dozen volunteers. We chose each other to evolve the committee.

It took a lot of time to pull together this committee. This was hard because I was dealing with a huge school district where inertia is a natural part of it. I had done a lot of background reading already and saw us losing momentum.

The first meeting with the teachers was around Thanksgiving. This was a late start. But the teachers were enthusiastic about getting together offstage, looking at the new materials, and using them.

Curriculum Planning

At the beginning there was this feeling that the curriculum writer had done all of this work, that he was the originator, that the teachers would use the materials, and in the committee meetings we would talk about revisions.

By January and February I told the teachers that they had to take a bigger share in shaping this. At this time I was doing the writing, but the group was beginning to suggest topics. Instead of bringing in a sequence of activities, I would bring in a collection of stuff and in the meeting we would decide what comes first and second, and so on.

Now I am more like their agent, like a car that they get to

drive, which is exactly how I want it to be. I still like to work it out myself beforehand, if I can. There is team work and they are not shy about saying what doesn't work. There is a real commitment to getting things done.

They are working hard between meetings to make sure this stuff works now. I have begun to do what they don't have time to develop. What I don't have is access to the kids to try it out on first.

The Problem-Solving Curriculum

This material concerns visual thinking and processing of information from visual to verbal and back again. There is a certain amount of problem-solving, in that we give the kids a problem and see how they deal with it. Some of this is my own and some of it is a spin-off from the math literature and conference sessions. It isn't in reference to the district's Course of Study. It is consonant with the Course of Study.

I'm not operating out of any really conscious theoretical construct. The goal is to give the kids things that we know they don't know how to do and the whole point is this: so what do you do? A good problem-solver has good resources to draw on, can stay calm, and doesn't give up. A good problem-solver may draw a picture, make a model or chart, list the steps, reread the problem.

Also, there are some things I know from what I've done with some kids. For instance, they like handling physical materials, a personal challenge, to work together, and to process information

from visual to verbal.

Each curriculum unit is a theme with a topic. It starts out fairly tame and then all these wrinkles appear as we go along. These wrinkles are the problems for the kids. The tasks the kids get toward the end of the week are supposed to be a real twist, quite different from the earlier ones, so that it's a real challenge to stay with it all the way through.

The teachers report back to me in the committee whether the kids like it, whether they can complete it successfully, and whether they think the kids are learning something from this. A convincing factor is whether the kids take it home at night and bring it back the next day.

The most positive response is that teachers say the kids are eating it up. Our teachers are pulling in from other classes, kids who will do nothing else, but will do this work. The strategy is that the 12 people on this committee will be pivotal for spreading this further. They will be like me.

However, the feedback I get isn't always satisfactory. For one thing, I can't tell whether there is any growth among the kids. I'm hoping that we can do some testing. Also, we need a graduate seminar where every time the teachers meet they do more and more of this material.

Teachers and Administrators at Cross-Purposes

What we are doing is brand new and is not in the textbook. According to some administrators, we can do anything we want because nothing that the system does works. We can throw

everything out. We have carte blanc to do whatever we want. There isn't an irstitutional road block that stands in the way, but rather the teachers' activity of implementing it and the principals' perceptions, prove to be obstacles.

However, when you propose something new to the teachers, they will say that you have to ask the principals because they want to raise scores on competency tests. Some of the principals would not agree to teachers using this material because they don't understand. These principals are always yammering about the scores on tests and have traditional ideas about teaching and testing.

I've got lots of questions about the authority of the teachers in reference to how hard kids are going to work. Teachers will say, "I don't dare flunk kids." Kids know the system has the teachers powerless to evaluate their work. For this reason I don't push evaluation of the teachers' work with these new materials.

Mr. Meder's Concerns

The teachers like doing this. The kids like it. But are we leaving something out of all this? I can't help wondering if we shouldn't be more concerned about the curriculum. I feel guilty about not having made a huge stack of curriculum materials.

Right now our work is a bit free and I am a little worried about what happens when we move it out to the district. This has to be tinkered around with a lot. We need somebody in the back of these classrooms watching this.

I'd feel better if a psychologist said, "This is exactly what these kids need." Or, if some math expert said, "This is just the math they need." I don't have anybody who oversees the mathematical worth of what we are doing. I'm worried that we may be just stuck in craft knowledge. Are we doing the best that we can? Isn't there something that is better than this? I think these materials should be going to some kind of review board.

I'm not sure things are going well with the curriculum planning. For instance, I passed this material out at the meeting last week. We did page one and then I passed out page two. The teachers said, "We should make page two before page one." Then, I gave them page three and they wanted it before page one. When I passed out pages four and five, they did the same thing with these pages. They said these last two should go before all of the others. I thought the material at the end was the hardest. Also, there were some technical changes on work sheets that they wanted done right away. So, I was to go home and rewrite the pages, but not put the page numbers on them.

I'd like to bring in something that they think is really good and then they talk about the various ways in which they can do this, rather than my bringing something in and they all say, "Oh, we gotta fix this." I've had experiences with teachers actually doing the writing, actually putting words down on the page. This doesn't always work very well, because the typical teacher doesn't always do that very well. It's hard when you are writing curriculum to write clear directions to students. And

it's hard to build through a work sheet a clear flow through the different problems.

It would be nice to have an experimental program, so that I could try it out first with a few students. The steps I would use for the curriculum process would be (1) do the conceptual work (2) write the curriculum, (3) try it out on the experimental program, (4) rewrite the curriculum, (5) have the teachers do the pilot testing, (6) get feedback from the teachers' pilot testing, (7) rewrite the curriculum and produce the polished materials.

However, I am really perplexed about how much I can expect these little work sheets to do. The kids drop out before high school. Should these little work sheets make kids like math so much that they will want to finish high school? One of the teachers raised this question: "Is this the fun and games aspect of teaching, the sugar coating for the regular classroom?" I don't know the answer to that question.

Learning is not always easy or pleasant. Am I prostituting math in order to amuse these kids? I don't know whether I can do what's best for the kids in the long run, if it might seem intensely unpleasant in the short run. The track coach can say, "You gotta run 30 laps today." He can say that because he's the track coach. The students want to be good runners and they believe him. Is math supposed to be the whip or the carrot?

Mr. Meder gave a mixed review of the project's results at the close of the first year. In the least, the teachers and the students enjoyed working

out the math problems, but on the whole the first year's results fell short of Mr. Meder's expectations. He believed that the work of the curriculum planning committee suffered from too little guidance. There should be an external board of specialists that reviews their products, a more rigorous design for the development of mathematical problems, and the district should reexamine its policies on competency based testing and teacher evaluation.

The latter points of criticism concern external factors. The comments from Mr. Meder also suggest that internal factors affected the committee's results. The late start, teachers' voluntary appointment to the curriculum committee, and wayward protocol contributed to negative consequences. When the teachers and curriculum writer met there was some confusion about work roles, a lack of agreement about the specific character of results, and little evidence of a common theoretical framework for problem-solving in mathematics. There was emphasis on control of problems, including order of introduction as well as their specific nature, and these preferences affected the operating definition of problem-solving.[10] The product of their planning was to be a workbook, but Mr. Meder expressed misgivings about its effect on the children's mathematical reasoning and the children's staying power until high school graduation.

The curriculum writer's perspective raises a number of questions, three of which are worthy of consideration at this point. What is the nature of problem-solving in the new mathematics? What should be the teachers' role in the preparation of the mathematics curriculum? What resources or mechanisms should be used to evaluate these problems? Mr. Meder's comments suggest that the project has given too little attention to the theory of mathematics and curriculum.[11] Lacking guidance from theoretical constructs, he sensed a need

for confirmation from external agencies or experts and generally avoided the teachers as well as the district's Course of Study. In the curriculum planning sessions, Mr. Meder took responsibility for the conceptual work and held teachers responsible for practicing the word problems and conducting pilot exercises with their students. The teachers' remained in a relatively passive role in reference to problem-solving and curriculum planning, and this had a negative impact on their assumption of responsibility for decision making.[12] While he was not discouraged, Mr. Meder was mildly annoyed about their stymied condition. He was inclined to see the workbook's publication as the answer to the project's struggles with problem-solving and curriculum planning.

In his discussion of the project, Mr. Meder rarely referred to the district Curriculum Director, who was responsible for supervising mathematics instruction. In the past this might have been a slight concern, but now things were different. The State of Ohio had passed legislation recently that required all districts to follow a Course of Study. Also, Cleveland City Public School Policy stipulated that all teachers plan according to Pupil Performance Objectives. The latter was a detailed listing of content specific objectives for competency-based instruction. In theory, this list was to be derived from the particular field of knowledge and the Course of Study; in practice, it was made up from the currently used textbooks and standardized achievement tests. There is some evidence that this school policy promoted teaching to the test.[13]

The relationship between Mr. Meder and the Mathematics Curriculum Director may be characterized best as uneasy, non-interference. Both men had concluded that the project lacked something important. For Mr. Meder it was a

proper source for guidance; for the Curriculum Director it was the district's Course of Study. When asked for his view of the project, the Curriculum Director had this to say:

There are some things coming out of the problem-solving project that are good, but it has some critical issues to deal with. Before they begin next year, they should have some kind of chart or plan that shows what should be produced and when. Let's imagine for a moment that the new school year is about to start. A math teacher has to know something about how to start out the year with problem-solving. They should ask themselves: How can we put problems together that begin to deal with some of the math concepts? They need some kind of a picture showing where they are headed and when they might get there. They should also ask: When do we introduce problem-solving? And how? Do we introduce a concept and then do a problem? Or, do we give the students a problem first and then the concept?

So, the project is kind of a hit and miss affair, in my opinion. It would be nice if they had enough activities, so that these could be coordinated with all of the chapters in the textbook. That way they could always be working with a concrete model. The bottom line is this: they have to give kids problems to solve. They've got to get the kids involved. So, the teachers want to teach problem-solving, but are they giving kids a chance to do it?

Where are we with the first year of work in? I think they

should have produced more by this time. The teacher empowerment thing is ticking off some of the other math teachers in the district, who are not on the committee. What if they get angry and decide not to use these materials, once they are developed? Who loses when teachers don't participate? It's not the principal or the teachers, it's the students. Also, the committee consists of some people who are just there for the fifty bucks. They are willing to do whatever they are told, so long as they get paid. What are they going to do about all of that?

In his remarks about the project, the Mathematics Curriculum Director expressed a skeptical opinion and seldom mentioned Mr. Meder. He wanted an explicit statement about the nature of problem-solving and a determination of where the problems would fit into the district's Course of Study. From his perspective, curriculum planning for problem-solving must give emphasis to pre-established conditions.[14] As things stood, the project lacked direction and left too much to chance. The general openness of the project led to insufficient results and may have contributed to unprofessional conduct on the part of some teachers. He seemed not to be concerned about the apparent contradiction of his view with mathematical problem-solving and a process theory of teaching and learning. The Curriculum Director was following this directive from his supervisors: ensure that all teachers followed the Course of Study.[15]

To clarify further the characteristics of the problem-solving project in its first year, the next section provides a description of the committee at work.

THE PROBLEM-SOLVING COMMITTEE AT WORK

In the spring semester of 1989, the 12 teachers met with Mr. Meder at the Math Resource Center two or three times per month on Thursdays from 3:30 until 5:30 or 6:00 p.m. Most were veteran teachers with 15-25 years of experience in the Cleveland City Public Schools. During these meetings it was typical for the teachers to devote time to practice on the work sheets, shop talk, and grousing. While the practice sessions dealt in a direct manner with concerns of the project, shop talk and grousing were deviations.

Practice on the Work Sheets

When Maxwell Meder called a meeting to order, many of the 12 teachers were present. That some were not, was due to a school district meeting, building level crisis, or some personal need. He devoted the first several minutes to introductions, relevant news, and small talk. Within a short time he adopted a business-like demeanor, getting all of the teachers assembled around a table and ready to begin a task.

Mr. Meder usually came to the meeting with a problem-solving exercise that he had prepared on work sheets. He distributed these in a packet, read the instructions, and asked the teachers to complete the assignment. His style included an openness that encouraged the teachers to talk about the exercise in terms of its immediate effects on them and their opinions about its possible effects on their students. Generally speaking, the teachers followed these instructions. From time to time they diverged from their task to cite problems they had with a previous work sheet, discuss their students' misbehavior, complain about work, or talk about the news.

The following is an introduction to a problem-solving exercise that the

teachers completed. These instructions to the teachers were accompanied by a packet of work sheets for the students, making up one unit in problem-solving. As soon as possible after their curriculum planning session, the teachers were to try this out as a pilot exercise with their students and report back to the committee on their findings.

Sixes

Each page is about a set of six pictures of block piles. Some are shown; the student is to draw others. The idea is to figure out the visual pattern and see how to continue it.

There are seven pages of problems, one page asking students to design their own set of six drawings, and one page of dot paper. (You should have a stack of dot paper on hand, I bet.)

You might use more than one page per day--make your own decisions. I put in a "part 2a" if you think part 2 is too easy or if you want an extra set at that point.

Charts

This set spins off the Sixes material. Each page shows one or two sets of six block piles. The blocks are to be counted and the chart filled out.

The chart goes beyond the set of pictures. The student must be clever in figuring out what happens.

The last line of each chart is for "n" blocks and expects students to invent a formula. Most of the formulas are within reach; some are very difficult. Use a light touch with these!

If students want to color in the blocks, that's fine.

Some of the charts have a number in square brackets: [2].
These numbers refer to the Sixes unit: [2] means Sixes, part 2.

You might want to interleave the Sixes pages with the Charts
pages, but warning! don't go out of order in either set. Sixes
part 1 has one of the hardest charts to fill out, for instance.

Students might want help in counting. In the bottom set on
page 2, it might be useful to write the number of blocks in each
stack on the top of the stack; then add.

The teachers completed the exercises during three consecutive meetings,
proceeding one sheet at a time, and somewhat slowly. Mr. Meder controlled the
pace so as to allow ample time for examining the pedagogical implications. As
they worked out the problems, he worked and talked--sometimes as a "student"
and sometimes as a "teacher"--about what he was doing. It was typical for the
teachers to ask technical questions, such as, "Should the students use colored
pens?" It was uncommon for the teachers to talk theoretically about problem-
solving, to discuss the implications of a particular exercise for teaching
mathematics as a science of pattern and order, or to explore strategies for
teaching with these materials.[16]

With the help of the committee, Maxwell Meder assembled at the end of
the first year a more or less polished collection of problem-solving exercises
for the intermediate level students. Many of the teachers had participated in
the problem-solving sessions held in the Mathematics Resource Center, tried
the exercises out on their students, and reported results to the committee.
There was some discussion about how to package these materials for use in the

next year. For instance, the teachers talked about whether it would be better to have the work sheets kept loose or bound in a workbook. The workbook idea had more appeal because in that way the teachers would not have to copy materials.

Shop Talk

When the teachers were not involved immediately in solving one of the math problems, they sometimes engaged in shop talk. The topics were wide ranging, but common to teachers. Sometimes the topic was a spin-off from the exercise. At other times it had a remote connection to the exercise itself, but a direct relationship to one's competence in the urban classroom. Practical knowledge and technical skill were chief characteristics of the teachers' shop talk.

As an example of a spin-off, one teacher described how her class responded enthusiastically to a problem-solving activity, but it disturbed teachers in adjoining areas of the open classroom building. The other teachers acknowledged that they had a similar reaction in their buildings with self-contained classrooms. Since all of the teachers were not present to report on this, they agreed to ask those who were absent to report on the same unit at the next meeting. The teachers then entered into a general discussion on techniques for managing classrooms and controlling student behavior. In the end they expressed their frustration about not catching students who are regularly disruptive and resolved that these students must be caught and expelled. How to deal with students, colleagues, and administrators was a popular topic for shop talk.

A more frequent topic for shop talk was the choice, production, and use of materials. At some point in the meeting one of the teachers would state

that their use of paper was causing a problem. Who was paying for this? What do we do if we run out? What about the complaints from other teachers in the building? Should we run off 150 copies at a time or just enough for one class at a time? A teacher would raise similar questions about the thermofax masters and transparency sheets. What kind should we be using? How can we make sure that there are enough to go around? Should each school get a box of masters or should we keep them at a central location? Someone present would give a practical answer to each of these questions. For instance, at one point there was a discussion about the quality of writing on thermofax masters. One of the teachers had with him what he believed was the best mechanical pencil. This pencil was passed around for all of the teachers to examine. When it seemed to be an administrative or clerical task, Mr. Meder took notes and told the group what he would do.

There were long discussions about using production equipment, such as the thermofax machine, overhead projector, screens, and ditto machines. Sometimes a teacher would impute that another teacher did not know how to use a machine correctly and that was the reason for unclear copies. This led someone in the committee to give a detailed set of instructions on how to run the machine correctly, what materials to use or avoid using, and what to do in the event of a breakdown. Production of work sheets for the problem-solving activities took time and the teachers, perceiving themselves too short on time, seemed compelled to give out explicit instructions for the operation of machines as well as tips and short cuts for operation.

Grousing

Although the teachers' shop talk bore little direct relationship to the project's problem-solving interest, it nonetheless had a positive and

professional aspect. However, some of the teachers' talk was a rambling complaint about the students and the misperceptions that administrators and other teachers had about the problem-solving project and its participants. In brief, the teachers were grousing. It seemed to stem from a personal interest, as for instance, "I want to get this off my chest," and often was stated in negative and unprofessional terms.

When grousing about the students, the teachers' complaints concerned the "weird results" they turned in, the low morale among students generally, and their boisterous or violent behavior. It was typical for a grousing session to begin when one teacher would tell what had happened that day at school. Then, other teachers would relate additional stories, pointing out how these were similar, sometimes more shocking examples.

In one instance a teacher began to make a fuss about using handouts instead of transparencies, saying, "All that these students really want are material possessions, like the handouts, and they want them immediately." A second teacher acknowledged that this seemed to be true, but added that it was at least a good basis for using a variety of media. To this the first teacher said, "We work so hard and try everything and get the same kids who come in and refuse to do a damn thing. We all have them. I feel like, Jesus, am I accomplishing anything?" At this point all of the teachers began talking and the meeting lost its focus. Mr. Meder called for a ten minute break, sensing its utility for diffusing the emotional response and refocusing the teachers' attention.

The grousing that these teachers did in reference to their superiors and co-workers seemed to stem from an often expressed perception of themselves as "willing to take a risk and try different things." Apparently, their peers,

not involved in this project, saw things differently, leading the project
teachers to assume a defensive stance.

The following conversation that took place at one meeting illustrates
the teachers' grousing about colleagues.

Gertrude: "We have a community here on the basis of a lot
            of things in relation to a lot of other
            divisions. The math division has generated a
            lot of cohesiveness for all of its projects.
            Other divisions are envious. It's kind of
            elitist. We get to go to Orlando."

Horace: "Yea. You can bust your buttons about something
            for a change. I told two people in my hallway
            about that Florida trip and they thought I had
            buttered up the principal."

Gertrude: "These are the perils of being good at what you
            do or trying to be good and caring: you get
            flack from your colleagues."

Horace: "Jealousy."

Gertrude: "This Collaborative is a life preserver. It
            gives me something to do, gives my kids
            something to do, and now we got this shit from
            them."

Horace: "They try to make you look bad."

Gertrude: "Yea. I've had people in my hallway actually go
            to the principal and lie, blatantly lied about

my work schedule. The principal comes up to me

and wants to know what the hell is going on.

Because you are good, they complain."

Horace: "But in reality you are getting all of the extra

jobs because you are so good. We need to do

something about the ass holes. That would raise

my morale."

This example of grousing reveals much about the project participants and

about the opinions of their co-workers and supervisors. From the point of

view of some of these outsiders, including the Curriculum Director, the

project participants had an unfair amount of material support for instruction,

too much freedom to veer away from the Course of Study, and undeserved

recognition and reward. From the perspective of the project participants,

their colleagues did not appreciate the risks involved in trying something

different for math instruction and were envious of the perks.[17] In the least,

their grousing was an unselfconscious effort to find relief from the stress of

sustaining an "us against them" relationship with colleagues. It had nothing

to do with problem-solving in mathematics.[18]

Rather than seeing curriculum planning for problem-solving as an

opportunity to examine the theoretical and practical aspects of their

mathematics instruction, the teachers tended to view and treat it as merely a

technical or mechanical matter.[19] By doing so, they kept themselves at a

surface level rather than delving into a more meaningful and productive level

of reflection, analysis, and critique of their math instruction. One gets the

impression that the teacher's work consisted entirely of monotonous routines

for tending machines, passing out work sheets, and monitoring the behavior of students. There was little said about pedagogical concerns of mathematical problem-solving or critical analysis and reflection, which leads to the issues of empowerment and judgment. Collaboration with colleagues rarely occurred outside of the project and some teachers in other disciplines held a jaundiced view of those who belonged.[20]

Although--according to the project--teachers were to assume responsibility for making decisions about mathematics instruction, their tendency was to focus attention on a narrow interest in technique and the justification for sustaining personal, and sometimes selfish, motives. The teachers missed an important craft-opportunity: that of fostering teacher empowerment in regard to taking responsibility for making decisions. This dignity has been long-overdue in the occupation. Considering the project's goals, these behaviors lowered expectations and led to unsatisfactory results. The researcher saw the project's altered purpose as an outcome that stemmed from the institutional conditions and the teachers' being accustomed to a passive role in curriculum planning.[21]

Another source influencing the teachers' behavior was their apparent lack of knowledge and skill with higher level organizational work.[22] Some of the teachers knew that their discussions of materials and machines had little to do with problem-solving and they recognized the gossipy lounge talk for what it was. Peer pressure, weariness from a day of work, and her own need for relief led teachers like Ms. Eunice Senter to refrain from raising the issue at meetings. She spoke privately about the committee's products and her classroom practice.

MS. EUNICE SENTER, A TEACHER, SPEAKS

Eunice Senter has been teaching mathematics for 15 years to intermediate level students at one of Cleveland's public schools. She has been an active member of the Problem-Solving Infusion Project since its start-up the previous fall. The researcher met her as she was hurrying along the second story hallway, returning an overhead projector to the equipment room. During class change time Ms. Senter was a conspicuous figure hustling through the throngs of students with the goggle eye of the projector bouncing high in front of her.

She explains herself voluntarily.

Some of our schools have chosen to cope with the high theft and vandalism rates by putting all materials in a central location and under lock and key. This works to prevent loss or damage, but prevents us teachers from using the equipment. The projector I had first hour had a broken lens. This is the only other one we have and when I got it back to my room, I found out that it was completely useless. The bulb was burned out and there was no spare.

She spots two girls from her last class and says, "Here, give me a hand." They giggle and say in unison, "Yes, Mrs. Senter." The taller one takes the overhead and the other holds the electrical cord. While the girls are in the equipment room, Ms. Senter and the researcher wait by a window overlooking the entrance to the school building. Down below someone abruptly

parks a rusted out pickup truck next to the curb. In the truck bed is an assortment of old tires, rims. jacks, trash bags and a large doberman pincer. A woman sits on the passenger's side. A tall, thin man with a scraggly beard gets out of the driver's side, tugging a girl. On his T-shirt is the following statement: "Fuck you very much." It is a blunt reminder that the social and physical causes of youth at risk are evident at the school.

Noticing this student's late arrival, Ms. Senter says, "That's what we have to deal with. Some of our kids come from homes that are determined to destroy just about everything we do." She leaves the window and gives the researcher a brief tour of the math lab. Then she returns to her classroom. During her preparation period in the quiet of the room, she talks about mathematics and the problem-solving project.

Teaching Problem-Solving

More and more of us are coming to know that the math curriculum has to have an experience base because these kids don't have the same opportunities as advantaged kids. In the past my own teaching style was to have kids sit still, listen, and be taught. There wasn't much attention to involvement with students, projects, creative teaching, and so on. In these last few years I've tried to change all that. The whole math curriculum needs to change, become more physical.

See those solid geometric forms hanging from the ceiling? I always look for ways to get the students doing things that involve math in some way and put their products up like that or on the bulletin boards. I've got them out in the hall, too. These

pieces of work help give the kids some sense of pride in school work.

I like doing this stuff. The kids do, too. The kid who made this geometric form usually does D - F work. One day last week he had just about everything done in the class. All he had to do was the top. He took a blank set of material home and figured out the whole thing on his own.

There are two benefits to the project material, like geoboards. You may think it is an insignificant problem to deal with, but you can have the students really engrossed in this. With other math problems they would get frustrated and quit. Here they can see it. This is something that can get the kids excited during at least a part of one class.

I'm always trying ways to generate a lot of interaction and conversation in the classroom. That's what it takes. Some classes are better than others. Last year I had a terrible class. There was a lot of swearing and cussing, even among the girls. This year it's different. However, I am a stickler for exactness. I do not accept answers that are poorly stated or inaccurate. This reinforces the logic and precision of mathematics.

Since we pulled together the project committee, I have a chance to see other math teachers on a regular basis. Before that I would see one only now and then, usually at a strike, and never on an educational basis. The math collaborative has made a big difference through the materials, guest speakers, conferences, and the calculator project.

At the meetings with Maxwell Meder, we talk about the problems he has developed, work them out ourselves, take them back to the classroom to try them out with kids, and tell him what did and did not work. Then, he revises them. The whole idea about that is once we have been through it we will in-service the other teachers in these specific problems.

Right now, it's like a testing period. We are taking all of the bugs out of it. The idea is to develop a workbook categorized according to the curricular area. So, depending on what you were working on, you would flip to the area and use the activities. Every one of them would be designed to work with something else because they are only supposed to be about ten minutes long. They are supplementary materials.

This is different from before when we would have to hunt to find our own materials. They might work once for one topic or another, but not for all. This is less time consuming than going to all of the books and trying to find something appropriate. It's so hard to find extra time to organize for a presentation. I have 150 students and that is a lot just to run the paper off for.

Ms. Senter's Concerns

The biggest problem is time. We have such a limited amount of time. How do you squeeze into the little time we have all of the work these kids need in math? It might be different if you could give the kids homework and they would do it, but they don't. I was standing here at my window watching the kids walk in the school this Monday morning. Most of them took no books home for

the weekend. Some might take a notebook or a folder, but no

books. Many kids come in on Monday, Tuesday, every day, with

nothing. That's discouraging.

Take this as an example, "Multiplying Fractions." They were

to take it home over the weekend and finish it. This one paper is

all I got back from one class. I got only a couple from another

class, and virtually nothing from the class I just dismissed.

I just don't know if all the math they need can be learned

in the class period. I try to give them so much in the bell work.

The bell work hits decimals, fractions, and so on, repeatedly. It

takes up most of the time. Sometimes I think that all I am trying

to do with the problem-solving projects is give them something

that is enjoyable to do and give them credit for it. Perhaps I

shouldn't be concerned about the fact that the kids don't do

homework. But then again maybe homework is a way of teaching

responsibility.

Another problem we have is selling this new stuff to the

public. Take the use of calculators in math classes, for

instance. Thanks to the Mathematics Curriculum Director, we are

on the forefront of using calculators in math. We aren't getting

the calculators just to do the computations. We are using them

for analyzing problems.

Not everyone is in agreement with this way of thinking about

teaching mathematics. For example, a local TV news editor spoke

out against this recently on the five o:clock news. The changes

we make we have to have a good explanation for or they will go

nowhere and we will fail to serve the kids in so many ways. It's the same with the problem-solving project.

The activities of the problem-solving project are so varied that the kids don't know where they come from and they coincide only now and then with the regular curriculum. For example, we might do some problems that have something to do with perimeter and find out later in the year where the project might fit in. This happens a lot. I suppose that the Course of Study is there to prevent that, but we don't seem to be following it at this point.

I once asked the students to tell me what they thought we were doing with the projects. They gave me answers like the following. "I have no idea how it fits in." "It's probably just a break or something." "It's fun." "It helps us figure out things, cause it helps you th'nk how they fit in things." "We get to do this because we have been good."

The real problem for us math teachers is this: How do we set up the math problems so as to encourage kids to think the problems through to solution, rather than apply a formula rote or do calculations? Some of the teachers are getting hooked on this. It's catching on more easily among elementary teachers than high school teachers. They are more resistant to opposition. They will say, "Who are you to tell me? I am an expert. I've been doing this for years."

Sources of Difficulty

I'd like to use the lab more often, but it's just about impossible. The schedule of classes, three minute class change time, late students, attendance, 40 minute class period. It all makes it very hard to bring students up to the lab. I've had many times when it's taken me most of the period just to get them to the right room and settled down. You need time to do a worthwhile project. The materials we have in the lab are great and the break away from the regular classroom is good for all of us, but most of the time I use the stuff down here.

It's not just the schedule. Take that girl whose dad dragged her in late. The kids bring in problems that make it very hard to teach. We have repeaters, over age kids, and messed up families. I have one boy in third hour whose parents have abandoned him. He's been in so much trouble with the law. It was the same with his three brothers. I've had them all. The foster homes have been a disaster for this boy. He does not know where he will be living next and may have to go to jail. When he's in class I have to be careful who sits around him because he'll start a fight over anything.

Attendance problems are another thing. A kid brings in a note, changes the unexcused absence to an excused absence. It was written by his friend not ten minutes before. How can you prove it was? You can't. We've inadvertantly conditioned them now that they can change their unexcused absences, but obviously these are not valid. In many cases the parents have no idea what they are

writing or else the kids do it themselves. Many of these parents
tell me they don't know what to do with their children. You have
a problem in the classroom and can't get help out there from the
parents.

The administration is "beating up on teachers" for failing
kids. Some principals demean teachers who consistently hold high
standards and threaten these same teachers with lower evaluations.
So, we keep two records: one we use for teaching and one we turn
in to keep our jobs.

The overhead projector is such an important machine for me
because it facilitates talking with the students. I have greater
flexibility with the speed I use to cover math. What is more, I
can maintain eye contact. That's the discipline factor. I am
able to look at the students while I work and don't have to turn
my back and write on the chalk board. This gives me better
control of the room. I can see all corners of the room. It
fosters a positive environment because it allows for a better
control of the room.

We have staffing problems that just shouldn't be going on.
A teacher will take a sick leave and a substitute will be brought
in on a long term appointment. It might be OK if they knew math,
but in most instances these subs are certified in English or
history. They start out the term with our students and before
long the damage has been done by them because these people don't
know math.

The principal's hands are tied to people who work in the building. When someone retires or quits, the building gets to interview a new person. However, all of the interviewees are sent here from downtown. Recently, they had to hire three new people. There were only three people sent out for the interviews. No choice was possible.

Moving in people who are good from another building is possible, but that has its problems, too. We would have to get rid of other people and we just can't get rid of somebody except for just cause. If they have the class under control, get good grades from the students, and so on, then what can you do? Even if they are not being creative and innovative. They may just want to do the routine.

And there are some concerns about the committee itself. Our behavior at the meetings is so typical of teachers. I find myself getting caught up in the gossip and shop talk. Some of the teachers are coming for benefits that have little or nothing to do with math. Some have a stake in it and others don't. Is this problem-solving? Are we just getting together to work out some neat problems. We play around with them and have our students play around with them. Some of us use them and some of us don't. I happen to know at least one person who does nothing with these materials we've made. Is this empowerment? Are we really doing curriculum work in math?

The interview with Ms. Senter revealed that her grasp of the Problem-Solving Infusion Project went well beyond a narrow interest in technique and avoided petty complaints about students and colleagues. She recognized in the homes and neighborhoods some of the sources for her students' low achievement in mathematics. She believed that disadvantaged urban children should be involved regularly in projects that entail manipulation of physical objects. Through these activities they would gain the required, wide-ranging experience and depth of understanding for mathematical reasoning.

The policies and organization of the school day are seen as hindrances to productive work with disadvantaged youth.[23] . . Senter identified several in-school factors which contributed to lowered expectations for teaching problem-solving at the school: herding of students, changing classes with several teachers, going to separate classrooms, inflexible and rigorous schedule, hiring unqualified teachers, administrators' monitoring of grades, and minimal commitment of teachers. The teachers' shallow tendencies at meetings suggested that a work place mentality was evolving at the expense of empowerment for professionalism.[24]

Like Mr. Meder and the Curriculum Director, Ms. Senter made an appeal for direction and an improved understanding of what teachers are doing with mathematics instruction, especially problem-solving. She believed that the planning and practice of mathematics instruction should be sensitive to the social context of the school and could benefit from a commonly held theory of problem-solving and curriculum planning. Although she did not say how the school district's competencies would aid students' achievement in problem-solving, she indicated that integrating the project with a Course of Study would at least provide consistency.

DISCUSSION

This account of the teachers' first-year effort with a problem-solving project shows how routine--one of many factors--can be a major deterrent to mathematics curriculum reform. Indeed, it is plausible that this report illustrates the "tyranny of custom" about which George Homans wrote.[25] According to the proposal, teachers would receive support for collaborative work to redesign the mathematics curriculum, which would result in their assuming more responsibility for decision making. Cleveland's intermediate level children would receive higher quality, up-to-date problem-solving instruction, which would improve their achievement in mathematics. However, despite this focus on mathematics curriculum reform, the teachers' practice was perceived to be weakened by particular conditions and policies of the school district. Also, the design for curriculum planning disfranchised the teachers by deferring to external authorities the conceptual aspects of problem-solving. The teachers' work routines--particularly, when collaborating--are seen as typical responses: they may have been ill-suited to achieving the project's goals, but were nevertheless effective coping mechanisms.

The end result was disappointing to the curriculum writer, Maxwell Meder, and to a teacher, Eunice Senter. They both offered informative explanations for what transpired in the first year. From Mr. Meder's perspective, there was too little guidance. He believed that if he could consult with a board of experts in mathematics, this would relieve his anxiety about choosing the right mathematics problems, correct sequence of presenting word problems, and appropriate processes for their solution. Although Mr. Meder was not satisfied with the first-year results, his tasks and conceptual

framework matched the project's guidelines. This was a typical proposal in regard to concerns for language and design. He was following a rational plan for curriculum development, including goals, objectives, and time-line.[26] His charge was to supply problem-solving exercises and train a small group of teachers to use these materials.

At the Math Resource Center, teachers practiced solving Mr. Meder's word problems collaboratively, returned to their schools to test the problems on their students, and then reported back to Mr. Meder with the results. Through practice sessions and experimentation, the teachers would know how to solve the problems and would know the organization of problems that was best suited to their students. In the second year this initial cadre of teachers would train other teachers, and so on until every intermediate level mathematics teacher in the district knew this material.

On the one hand, Mr. Meder thought that the difficulty he and the teachers were having could be resolved once they produced the workbook of word problems in conformity with school district's Pupil Performance Objectives. On the other hand, however, he acknowledged that the workbook could possibly interfere with the new problem-solving curriculum for the same reasons as published materials of bygone eras: workbooks stifle thinking and discourage creativity and innovation. His avoidance of the Curriculum Director, Course of Study, and the Pupil Performance Objectives suggested that he regarded all with suspicion. It seemed inevitable that their "reform" of problem-solving would be coopted by the very thing they were trying to replace--the static and irrelevant status quo.[27] His musings at the end of his speech indicated that he thought there were serious discrepancies between the direction in which they were headed and the intent of the new standards. He was searching for

sources of difficulty among students, teachers, schools, and their revised mathematics curriculum.

The observation of Eunice Senter's classroom showed that she had a strong commitment to her students and that she was a resourceful, creative teacher. Her viewpoint about the project was informed by the work she did with Maxwell Meder, the administration and students at her school, and her colleagues at the Math Resource Center. During project meetings she was aware of her colleagues' less-than-professional behavior. Although their routines, such as shop talk and grousing, were having a negative effect on curriculum planning, they were unsurprising: they were typical mechanisms for getting relief from the frustrations of teaching. Although Ms. Senter believed the mathematics project was having a positive influence on her own teaching, she felt not only discontented with its first-year results, but also frustrated over the policies and practices of her school.

The teacher directed, textbook approach, that she and her colleagues had depended upon before the project, was not satisfactory. The urban children's achievement in mathematics could be improved with the project's techniques, particularly, where problem-solving lessons included manipulatives, such as geoboards, containers, figures, rulers, and so on. However, these new math problems would be mere frills or distractions, unless they could become part of an encompassing and evolving curriculum plan. In her intermediate school Ms. Senter did not let the piecemeal reform drive her into giving up. She chose to stick with the program, albeit fully aware that a much greater effort was required for the urban children to achieve real success in problem-solving.[28]

The project was stymied by the institution's oppressive systematic programming, in general, and its over-dependency on routine, in particular.[29] Despite laudable efforts on the part of individuals, like Mr. Meder and Ms. Senter, there was confusion about experimental planning as well as frustration over using innovative or creative techniques in schools organized for traditional operation. John Dewey noted in his remarks on "The Chicago Experiment" that the intention of his experimental program was not to develop a "practice school, nor (in its purpose) what is now called a 'progressive' school."[30] A curriculum reform project devoted to practice, such as this one at Cleveland, would be a study in contradiction.[31]

Dewey's position on experimental curriculum planning is instructive. He wrote:

First in importance is the conception of the problem of education. In substance this problem is the harmonizing of individual traits with social ends and values. Education is a difficult process, one demanding all the moral and intellectual resources that are available at any time, precisely because it is so extremely difficult to achieve an effective coordination of the factors which proceed from the make-up, the psychological constitution, of human beings with the demands and opportunities of the social environment. The problem is especially difficult at the present time because of the conflicts in the traditions, beliefs, customs, and institutions which influence social life to-day. In any case, it is an ever-renewed problem, one which each generation has to solve over and again for itself; and, since the

psychological make-up varies from individual to individual, to some extent it is one which every teacher has to take up afresh with every pupil."

Dewey's main point is this: an experimental curriculum supports the continuous pursuit of understanding that is both moral and intellectual. Concerning the intellectual aspect, curriculum planning includes the selection and study of subject matter with consideration for its best reorganization and presentation to particular students. In this way experimentation is a constituent feature of the teacher's interactions with students. Experimentation is not a detached series of continual practice exercises." Concerning the moral aspect, today there is an epidemic of disadvantaged children. Their daily lives are steeped in poverty, hunger, hopelessness, violence, drug and alcohol abuse, AIDS, transience, homelessness, and adolescent parenthood. The personal and social aspects of childhood in Cleveland make solving the problem of education an evident and especially difficult moral imperative."

Continual emphasis on practice obscures the real value and function of experiment in curriculum planning and postpones the day when moral and intellectual education benefits will accrue to these children. That some of these teachers were deficient in math knowledge and some were indifferent is manifested in the teachers' continual practice of word problems. In the least, many lacked an understanding of what could make mathematical problem-solving a vital interest to these children. In either instance, an intensive effort should be undertaken to improve the teachers' grasp of mathematics.

Ironically, the nature of problem-solving itself was the most troublesome aspect of the Problem-Solving Infusion Project--in reference to

school reorganization, curriculum planning, and mathematics. Cleveland's intermediate schools are organized in accordance with the traditional model. School continued, despite the teachers' frustration about their powerlessness and the students' need for flexibility, alternative scheduling, and choice. Everyone was familiar with the district's standard operating procedure, but, for some teachers at least, it was all-too-familiar. Ms. Senter's explanation showed how a teacher's practice was necessarily affected by her students' characteristics. However, when she planned to use innovative methods and materials, her choice was compromised by school policy.

If the district's formal organization did not openly discourage teachers from using innovative and creative techniques, its emphasis on supporting routines did. Systematic teaching and competency based learning were the district's most highly regarded strategies for insuring compliance with the state legislature and the court-ordered desegregation. These policies and practices subtly discouraged the teachers' from functioning as autonomous professionals.[35] Teachers would risk losing their jobs when deviating from the Course of Study. The teachers' behavior at the project meetings suggested that, for them, too, routinization had become commonplace, even definitive. With the first year of the project behind them, their decision making would involve no more than adjusting minor details while teaching word problems, which was not different from their previous role expectancies. Resistance to reform was an inherent feature of this traditional system.

Systems do not make moral and intellectual decisions; people do. A city, like Cleveland, has a moral responsibility to trust its public school teachers to be more responsive to the children's needs. For political as well as pedagogical reasons, providing effective instruction in problem-solving is

a step in the right direction. However, it must be seen as one aspect of an emerging, broad-based effort toward curriculum reform and urban school reconstruction, otherwise "the second wave" of reform may remain piecemeal and ineffective.[36] The quality of mathematics instruction is bound up with the urban children's achievement in mathematics. Their mutual improvement depends upon a national research program devoted to intensive inquiry of process-oriented teaching and learning.[37] Also, the comprehensive improvement of an urban education program requires policymakers to address three concerns: establish the promotion of students' learning as the teachers' primary responsibility; make individual schools into consistent, intensive, and flexible institutions for educating present-day children; and coordinate a network of local services for the social and physical welfare of children. Finally, any effort to improve America's urban public schools must be linked to the particular city's plans for urban renewal and reconstruction.[38] When these concerns become the basic principles of urban school reconstruction, teachers will assume the rights and responsibilities appropriate to their occupation. Desperate children will learn problem-solving and will know that a formal education offers hope for tomorrow.

Notes

¹See <u>Everybody Counts: A Report to the Nation on the Future of Mathematics Education</u> (Washington, D.C.: National Academy Press, 1989); and Thomas A. Romberg, "NCTM's Curriculum and Evaluation Standards: What They Are and Why They Are Needed," <u>Arithmetic Teacher</u> 35 (May 1988): 2-3.

²See Charles E. Bruckerhoff, <u>Removing the Stigma of Disadvantage: A Report on the Education and Employability of 9 - 15 Year Old Youth 'At Risk,'</u> Research Report No. 88-09 (Washington, D.C.: National Commission for Employment Policy); <u>An Imperiled Generation: Saving Urban Schools</u>, The Carnegie Foundation for the Advancement of Teaching (Lawrenceville, NJ: Princeton University Press; and Lisbeth B. Schorr, <u>Within Our Reach: Breaking the Cycle of Disadvantage</u> (New York: Basic Books, 1989).

³For a discussion of critical aspects of the "second wave of reform," see Harry Judge, "Afterword," in <u>Building a Professional Culture in Schools</u>, ed. Ann Lieberman (New York: Teachers College Press, 1988), pp. 222-31.

⁴The method used for this research is similar to that described by Louis M. Smith et al., <u>Educational Innovators: Then and Now</u> (New York: The Falmer Press, 1986), pp. 16-26; a major difference between this study and that by Smith and his associates is that their investigation examined the evolution of a district over 65 years of time.

⁵See William Snider, "Cleveland School Officials Move to Avert State Takeover," <u>Education Week</u> (February 7, 1990): p. 5.

⁶For a revealing discussion of the school board's relationship to its local, social and political contexts, see Louis M. Smith et al., <u>Innovation and Change in Schooling: History, Politics, Agency</u> (New York: The Falmer Press, 1988), pp. 306-309.

⁷The word, routine, is used in the present context to signify a pattern, a repeated structure of behavior, or customary way of acting. This notion has been adapted from George C. Homans, The Human Group (New York: Harcourt Brace and World, 1950), pp. 28-29.

⁸See An Imperiled Generation, pp. 34-39.

⁹While believing it to be an attainable end, authorities express some disagreement regarding the best approach for school reform. See, for example, Diane Ravitch, The Troubled Crusade: American Education 1945-1980 (New York: Basic Books), p. 261; Schorr, Within Our Reach; and Gary G. Wehlage and Robert A. Rutter, "Dropping Out: How Much Do Schools: Contribute to the Problem?" in School Dropouts: Patterns and Policies, ed. Gary Natriello (New York: Teachers College Press, 1987), pp. 70-88.

¹⁰A Course of Study must have some kind of theory. In this instance the NSF project needs a process oriented theory of teaching and learning, not the typical, rational plan. See, for example, Donald Oliver and Kathleen Waldron Gershman, Education, Modernity, and Fractured Meaning: Toward a Process Theory of Teaching and Learning (New York: SUNY Press, 1989).

¹¹Indeed, the difficulty that Mr. Meder is experiencing may signal a deficit in the field of mathematics, due to its dramatic growth in the past 50 years and the potential yet to be realized from modern technology, especially the computer. The need for research to develop grounded theory of teaching and learning of mathematics is argued persuasively by Thomas A. Romberg and Thomas P. Carpenter, "Research on Teaching and Learning Mathematics: Two Disciplines of Scientific Inquiry,. in Handbook of Research on Teaching, ed. M. C. Wittrock (New York: Macmillan, 1986), pp. 850-73.

¹²For a recent examination of curriculum reform movements and their contribution to loss of teacher autonomy, see Diane Ravitch, The Troubled Crusade, pp. 317-19; one scholar decries the teachers' loss of decision making power as a by-product of staff development policy, systems design, and instructional materials: Frederick Erickson, "Tasks in Times: Objects of Study in a Natural History of Teaching," in Improving Teaching, ed. Karen K. Zumwalt (Association for Supervision and Curriculum Development Yearbook, 1986), pp. 131-48; another scholar argues that teachers need to help determine curriculum in substantive ways, otherwise they will not develop a sense of ownership and they will not feel at one with the materials they use: Gene I. Maeroff, The Empowerment of Teachers: Overcoming the Crisis of Confidence (New York: Teachers College Press, 1988), p. 54.

¹³See Charles E. Bruckerhoff, "Teachers on the Board: The Cleveland Collaborative for Mathematics Education" (Paper delivered at the Annual Meeting of the American Educational Research Association, San Francisco, March 27, 1989), pp. 41-44.

¹⁴For a penetrating analysis of programed instruction and its contribution to lack of trust of teachers, see Frank Smith, Insult to Intelligence (New York: Arbor House, 1986), pp. x, 12, and 126.

¹⁵The misunderstandings between administrators and teachers are explored in Maeroff, The Empowerment of Teachers, pp. 79-90; and the bureaucratic and top-down nature of schools are examined in Theodore R. Sizer, Horace's Compromise: The Dilemma of the American High School (New York: Houghton Mifflin Company, 1985), pp. 206-13.

¹⁶The terms, critical thinking and problem-solving, are considered by some scholars to be shopworn and to have no real history in American schools,

because Americans have relatively simple conceptions about teaching and learning. See, for example, Kathleen Devaney and Gary Sykes, "Making the Case for Professionalism," in Building a Professional Culture in Schools, p. 10.

[17]The teachers in this study are similar in their commitments and perceptions to the "all good group" and the "all bad group" identified by Louis M. Smith, et al., Innovation and Change in Schooling, p. 336.

[18]For an examination of how the current organization of teaching tasks fosters "conservatism of outlook," see Dan C. Lortie, Schoolteacher: A Sociological Study (Chicago: University of Chicago Press, 1975), p. 232.

[19]Some of the recent proposals for school reform may actually lock teachers into "vocational visions of education, visions pursued by equally simple and instrumental versions of pedagogy and curricula," according to Michael W. Sedlack, et al., Selling Students Short: Classroom Bargains and Academic Reform in the American High School (New York: Teachers College Press, 1986), pp. 177-78; some critics argue that, ironically, curriculum reform movements may trap teachers and students into a pedagogy that is more open to technological scrutiny and managerial control, in contradiction to the idea of teacher empowerment, see for example, Thomas S. Popkewitz, "Culture, Pedagogy, and Power: Illues in the Production of Values and Colonization," Journal of Education 170, no.3 (1988): 77-90.

[20]Teachers' decisions are limited by parameters set by authorities in reference to critical aspects of their work, such as curriculum, school improvement, and professional development: this is a problem of "received power," according to Myrna Cooper, "Whose Culture Is It, Anyway?" in Building a Professional Culture in Schools, p. 51.

[21]"Apparently, these teachers were different from the innovators studied by Louis M. Smith, et al., Educational Innovators: Then and Now, pp. 200-201; I concur with Smith, et al. 1986, p. 224, regarding their argument that innovation is not only a political and cultural problem, it is also a person problem: getting the right persons--those with good skills and a strong commitment--into the profession.

[22]See Maeroff, The Empowerment of Teachers, pp. 54-55 and 100-104.

[23]Change in an organization can be seen as a systemic problem: how much change can an organization tolerate? To the extent that external social and political problems impact on the learning mission of the school, the institution may resist change and, instead, maintain a narrow definition for its educational program. See, for example, Louis M. Smith, et al., The Fate of an Innovative School (New York: The Falmer Press, 1987), p. 282.

[24]Popkewitz, "Culture, Pedagogy, and Power", p. 90, aware of the potential for a work place mentality or teacher apathy, raised this caution at the close of his article: "The tensions, struggles, and contradictions do not mean we should forego the challenge. Rather we should recognize the need for trust with skepticism."

[25]See Homans, The Human Group, p. 29.

[26]For an examination of the discourse and discourse/practices in education that stem from positivism and technocracy, see Cleo H. Cherryholmes, Power and Criticism: Poststructural Investigations in Education (New York: Teachers College Press, 1988); for a comparison of alternative conceptions of curriculum planning, see Elliot W. Eisner, The Educational Imagination: On the Design and Evaluation of School Programs (New York: Teachers College Press, 1985), pp. 109-26; a broader analysis of contributions from poststructuralism

to educational research is explored by Tom Popkewitz, <u>Paradigm and Ideology in Educational Research: The Social Functions of the Intellectual</u> (New York: The Falmer Press, 1984).

[27]Educators and the public, alike, have different expectations for schools and use a different language--empowerment, participation, decision making--to talk about teachers' work, but has there been a substantive change in the practice of teaching? Claims about the passing of "traditional ways" in favor of the "new outlook" may contain an ironic twist: in place of "lectures," there are demands for rationality, goal specification, and empirical validation of claims. A critical analysis may lead one to conclude that "the more things changed, the more they remained the same." See, for example, Lortie, <u>Schoolteacher</u>, pp. 217-18.

[28]A national survey reports that teachers remain skeptical about the effects of reform actions taken thus far. See <u>Report Card on School Reform: The Teachers Speak</u>, The Carnegie Foundation for the Advancement of Teaching (Lawrenceville, NJ: Princeton University Press, 1988), pp. 10-11.

[29]Routines are an important part of all operations, including schools. For an organization to remain fairly stable, these patterns of behavior must be finely tuned. An interest in changing the order of things is naive, if it does not acknowledge an organization's dependence on routines; it will lead inevitably to "political flack" for someone. Hence, the status quo prevails because it is so difficult to change anything without influencing everything else. See, for example, Sizer, <u>Horace's Compromise</u>, p. 211.

[30]See Katherine Camp Mayhew and Anna Camp Edwards, <u>The Dewey School</u> (New York: D. Appleton-Century Company, 1936), p. 464.

³¹Regarding the latter, the ideals of Dewey's progressivism had long since been compromised by the child-centered schools and utilitariansm, although both of these forces continue to exert their influence on the school curriculum. See especially Herbert M. Kliebard, The Struggle for the American Curriculum: 1893-1958 (New York: Routledge and Kegan Paul, 1986), pp. 27-29.

³²See Mayhew and Edwards, The Dewey School, p. 465.

³³For a more recent statement on the centrality of the teacher-student relationship, see Cooper, "Whose Culture Is It, Anyway?" in Building a Professional Culture in Schools, p. 54.

³⁴For a discussion of problems that American kids bring to school today, see An Imperiled Generation, p. xiii; and Sizer, Horace's Compromise, pp. 40-52.

³⁵Popkewitz, "Culture, Pedagogy, and Power," p. 80, calls attention to the expectations and limits that are set on teachers' work by the discourses and discourse practices embedded in state legislation and standardized tests; and, thus far, teachers enjoy little or no legal protection for professional autonomy when choosing content and methods, see for example, Donal M. Sacken, "Rethinking Academic Freedom in the Public Schools: The Matter of Pedagogical Methods," Teachers College Record 91, no. 2 (Winter 1989): 235-55.

³⁶Authorities appeal increasingly for a comprehensive approach to school reform. See Linda Darling-Hammond, "Policy and Professionalism," in Building a Professional Culture in Schools, p. 73; and The Condition of Teaching: A State-By-State Analysis, 1988, The Carnegie Foundation for the Advancement of Teaching (Lawrenceville, NJ: Princeton University Press. 1988), p. xvii.

³⁷See Romberg and Carpenter, "Research on Teaching and Learning Mathematics," p. 869.

"For a compelling argument favoring the integration of social and
political ends in the reconstruction of urban communities, see Lewis Mumford,
The City in History: Its Origins, Its Transformations, and Its Prospects (New
York: Harcourt Brace and World, 1961), pp. 168-71; see also Smith, et al., The
Fate of an Innovative School, p. 282.