DOCUMENT RESUME

ED 308 191 SP 031 549

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TITLE Classroom and School Research: Investments in Enhancing Schools. Laboratory Policy Paper.
SPONS AGENCY Office of Educational Research and Improvement (ED), Washington, DC.
PUB DATE Apr 89
NOTE 95p.; For other documents related to the Regional Educational Laboratory recompetition of 1990, see SP 031 546-556.
PUB TYPE Reports - Descriptive (141)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS Classroom Research; *Educational Research; Elementary Secondary Education; Financial Needs; *Information Dissemination; Instructional Improvement; *Needs Assessment; *Research Needs; *Research Utilization; School Effectiveness; Theory Practice Relationship
IDENTIFIERS *Regional Educational Laboratories

ABSTRACT

This paper discusses the adequacy of research for informing practice and areas of research that will extend the knowledge base about schooling. The first topic also includes the extent to which existing knowledge has been disseminated. The second topic involves the identification of research topics that merit funding so that knowledge that can inform school improvement programs will be enhanced in the future. Despite the inadequacy of research to date, recent research has yielded important knowledge that is of value to educators. However, this research has only begun to address the basic questions that must be answered if student learning in school settings is to be understood. A summary is offered of classroom and school research that has the ability to inform practice; the need to integrate these two areas is emphasized. In regard to topics that merit new funding, it is pointed out that it is most important to support research that promises sustained programmatic inquiry about salient classroom issues, integrating work on curriculum as well as on teacher and student variables. The present knowledge base and issues are discussed, and a research agenda is suggested. The role of regional laboratories, in view of extant and pending research, is briefly discussed. (JD)

LABORATORY POLICY PAPER

CLASSROOM AND SCHOOL RESEARCH: INVESTMENTS IN ENHANCING SCHOOLS

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April 1989

This is one of several papers about the regional laboratory program, or functions which laboratories perform, which the Office of Educational Improvement (OERI) in the U.S. Department of Education has commissioned. The purpose of the papers is to assist planning for the 1990 recompetition of awards to operate regional laboratories. This paper has been written under contract to the U.S. Department of Education. No endorsement by OERI or the Department of Education should be inferred.

Classroom and School Research: Investments in Enhancing Schools

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[1] I acknowledge the support provided by the Center for Research in Social Behavior at the University of Missouri-Columbia and especially thank Teresa Hjellming and LeeAnn Debo for typing the manuscript and Gail Hinkel for editing it. Also, I want to thank Bruce Biddle, Jere Brophy, Mary Rohrkemper, Susan Rosenholtz, and Sam Stringfield for their valuable suggestions about the manuscript.

[2] This paper has been prepared at the request of OERI; however, the views expressed here are those of the author, and no endorsement by OERI should be inferred.

Introduction

I was asked to discuss two topics in this paper: (1) the adequacy of research for informing practice, and (2) areas of research that will extend our knowledge base about schooling. The first topic also includes the extent to which existing knowledge has been disseminated. The second topic involves the identification of research topics that OERI and other interested agencies could fund so that knowledge that can inform school improvement programs will be enhanced by the year 2000. Since I -- and everyone I have consulted within the field -- concur that the extant knowledge base for understanding schools and classrooms is inadequate, I will focus on areas that merit subsequent research and development.

Concerning the adequacy of research for informing practice, I argue that there is comparatively little research knowledge because historically (a) innovation has preceded research, (b) the social value attributed to educational research has been low, and (c) little programmatic research has been conducted. Despite these problems, recent research has yielded important knowledge that is of value to educators. However, this research has only begun to address the basic questions that must be answered if we are to understand student learning in school settings. In discussing the ability of research to inform practice, I summarize both classroom and school research, although I emphasize the need to integrate these two areas.

In addressing the issue of topics that merit new funding, I intend to create a research "vision" without being overly specific about research questions and research designs. It is clear to me that the field currently needs a broad and rich infusion of basic research that is

reasonably comprehensive. Needed is knowledge about a set of core issues if we are to make progress in understanding school learning. It is most important to support research that promises sustained programmatic inquiry about salient classroom issues. The research that I advocate calls for integrative work on curriculum as well as on teacher and student variables. I emphasize that researchers cannot study teacher behavior independently of knowledge of teaching thinking, student behavior and thinking, or curriculum variables. Before discussing the adequacy of the knowledge base I briefly introduce the new areas of research. Then I discuss the present knowledge base and issues (attitudinal and funding) that need to be improved if new research is to be productive. Following a review of the extant knowledge base, I present the research agenda that I believe should be supported. Finally, I briefly discuss the role of regional laboratories in view of extant and pending research.

Research Base

Although knowledge about educational practice is relatively meager and much of it is misused, I do want to emphasize that past educational funding has resulted in a knowledge base that has both theoretical and practical significance. The minor investments in educational research have already provided potentially powerful dividends (depending on how knowledge is used), and I am confident that continued funding will lead to richer conceptualizations of schooling. This knowledge can be of use to state and local educators who spend the time necessary to understand both the knowledge and its limitations and who apply it to local contexts. By analogy, the developers of the most powerful miracle drugs currently available agree that those medicines will (a) be refined by new research,

and (b) offer simple cures neither for the common cold nor cancer. Considering the comparatively low funding of educational research (in contrast to medical research), it should come as no surprise that knowledge about schooling is fragmentary and uneven; however, in contrast to their attitudes towards research in medicine (and in other disciplines), many politicians want to continue to limit (or eliminate) funding for educational research because it does not yield definitive answers.

Before discussing the research areas that will yield important knowledge, I want to briefly place the call for more research in a larger policy framework that examines both the structure and level of research funding. I argue that research funding in this country is both inadequate and deteriorating. Further, although I am "bullish" on research, we need to delineate carefully what research can and cannot do. One of the past difficulties in obtaining support for research has been educators' creation of inordinately high public expectations and the failure to fulfill those expectations.

Simply to remain even with funds that were spent in 1973 on basic research and development in education, the federal government would need to increase its investment in educational research by 600%. Such an increase (and much more) could be spent wisely to expand our knowledge of classrooms and schools in ways that would enhance students' mastery of basic curriculum concepts, capacity for critical thinking, and ability to use knowledge to address societal problems. I have emphasized areas of research and development that seem to be a logical extension of past investments of NIE and now OERI. I do not argue that these are the only

or the best investments to make, but rather that they expand programs of research supported by the federal government in the past. These areas are summarized in the next section and discussed in more detail later in the paper.

Areas of Research That Merit Funding

New research needs to focus on the curriculum so that we can better conceptualize important subject-matter variables and develop tasks that require students to integrate knowledge. New conceptualization and research are needed if we are to move the curriculum from a "coverage" perspective to one that stresses understanding. In particular, it is necessary to include in the curriculum more activities that encourage students to think and reflect so that there is a balance between higher-order and lower-order thinking.

New work must address how students react to instruction and curriculum assignments. Considerable evidence suggests that many students have learned to be passive in classrooms, and this must change if students are to take some responsibility for their own learning.

Another research area that must be continued -- but with a new focus -- involves teachers' thinking and its relation to their classroom behavior. Researchers need to build conceptual bridges between teachers' views of curriculum and students, and teachers' classroom decisions and performance. There are numerous studies of teachers' thinking and behavior; research that examines both student and teacher behavior and thought simultaneously is needed.

New research should study schools as institutions and how resources in schools can be allocated in ways that encourage students, teachers, and

administrators to engage in intelligent, productive behavior. There is growing evidence that productive behavior may vary according to the school or classroom context. For example, the structure and climate in some schools encourage critical thinking and the sharing of useful ideas among teachers. Unfortunately, other school environments promote less adaptive behavior. More information is needed about how both desirable and undesirable norms and institutional practices develop and are sustained. Finally, if students are to be more active learners, schools should encourage teachers to be more active (e.g., model appropriate learning processes) but at the same time assist students to assume increasingly more control of their own learning.

Although research on these topics will extend knowledge of schooling, it will not yield a comprehensive understanding of schooling because so many other topics need to be studied. Although I do not discuss these topics in detail later in the pages, I summarize several of them below.

Teacher recruitment and retention are key issues for the 1990s. The number of talented individuals who enter teaching is not as large as it once was. Because the conditions of teaching are not as attractive as they once were, the most talented teachers leave the field earlier than others. The recruitment and retention of minority teachers are of special concern. The United States faces an immense problem of establishing more educational and professional opportunities for minorities. This problem begs for fresh conceptualization, creative problem solving, and progress. Eubanks (1988) notes that data clearly show an impending shortage of minority teachers in 47 of 50 states. He notes that the higher the education level, the fewer the number of minorities enrolled. One could

reasonably argue that without better adult role models, there is less incentive for minority students to fulfill their potential in public schools. However, this issue must be broadly addressed and conceptualized.

We need to learn why talented teachers leave teaching and then we must develop models for improving the conditions under which teachers work. Stringfield (personal communication) argues that in exploring these questions researchers should use longitudinal studies of why people go into teaching and why they stay, because cross-sectional data do not provide particularly compelling or useful information. Why do only one-half of the persons who receive bachelor's degrees in education teach even one year? What are the other half doing? Who is surviving the first year? Why do they survive? After five years of teaching are teachers satisfied with the basic role of teaching and have they continued to grow as professionals or have they developed routine ways of responding to classroom issues?

Educators must also learn how to use computers to improve classroom learning. Despite the computer's potential, we still have little knowledge about how it is used and whether it improves students' capacity for thinking and problem solving. Some disturbing data suggest that minority and low-income students' access to computers is more limited than students of higher socioeconomic status. This is a problem that must be explored. If inequities exist, they must be corrected.

Lepper and Jurtener (1989) note that several advantages of using computers in schools have been challenged. Advocates believe that the computer can make learning more intrinsically motivating, lead to a

school curriculum that emphasizes more cooperation and collaboration, or increase equality of educational opportunity (i.e., it is fair and does not judge learning today narrowly in terms of what a learner did yesterday). However, others argue that because computers are more readily available in some schools than others, they extend or at least sustain inequalities in educational opportunity.

According to Lepper and Jurtener, the outcomes of computer usage are also related to the number of computers available in a school. In some classrooms, all students have access to a computer; in other classrooms there may be only three computers for 30 students. Some schools may have only three computers. In addition, how students use computers is also important. Unfortunately, as Lepper and Jurtener point out, good empirical research is sorely lacking. They call for more theoretically-based research that focuses on the underlying processes in which students are engaged, in particular the direction and intensity of the students' attention as they use computers. Becker (1986) offers useful advice about research that document the effects of computer utilization on student learning.

There is increasing evidence that the language and the ways students approach educational tasks are influenced by interaction in students' homes (see Rohrkemper, in press). Some of the "unalterable" variation associated with schooling may therefore be alterable by making changes in the home or with joint home and school action.. Obviously, both parents and schools have limitations in this area, but by combining home and school resources it may be possible to increase students' expectations and performance significantly. Unfortunately, research indicates that these

relationships are most problematic between schools and low-income families (Grantlinger, 1985, 1987). We must alter the situation in which the economically deprived either perceive or receive less from the schools than do other families.

Educators have much to learn from comparative education, the study of educational systems in other countries, which offers many opportunities for reconsidering, and perhaps changing, some educational practices that we take for granted. For example, Japan provides teachers 20 in-service days per year. Are some of the coherence and attention to understanding that characterize the Japanese curriculum related to teachers' use of this time to consider educational practice? As various educators have indicated (e.g., Romberg, 1988) the U.S. is the only first-world country in which teaching is a 9-month job. Perhaps by extending the school year by a few weeks and paying teachers adequately for the additional time, their productivity and job satisfaction might be enhanced. In some countries the literacy rates exceed our own (e.g., The Netherlands), and in other countries (e.g., Japan) students' mathematical performance greatly surpasses that of U.S. students. By studying how these countries develop curricula we might better understand both the strengths and the weaknesses of our own educational approaches. For too long funding agencies have viewed investments in comparative research as nonessential. However, if educators want understand some of the best exemplars of educational practice, researchers need to study practices in other countries. Because complex and subtle societal factors as well as schooling practices may differentiate countries (e.g., Holloway, 1988),

successful comparative research will involve competent bilingual observers and interviews. Such research is not inexpensive.

Finally, knowledge about how research is used is limited and is an area that deserves research. Bruce Biddle (1989) contends that the extent to which policymakers use social research is an enigma. Some believe that social research produces knowledge that improves public policy. Many other scholars, however, hold that this research has little effect on policy decisions and that it produces knowledge that is not disseminated, is ignored, or is blatantly misused by policymakers. If research is utilized, it is important to learn the role that it plays. Do research findings and concepts help to define "problems," or do policymakers view educational research only as part of the "solution"? Are administrators familiar with research conducted in the last 20 years? Are they willing to read original reports or to have staffers read them, or are they content to read second- and third-hand accounts of research?

Adequacy of Research for Informing Practice

Having summarized topics that require additional research, I now consider the role of research in forming school policy. I discuss past constraints on the development of a knowledge for base for understanding classrooms because the failure to recognize structural weaknesses may cause new research to be relatively ineffective. Historically, educational innovation has preceded research, in part because educators are expected to produce immediate solutions to problems. Further, funding for educational research has always been too limited, mak.ng it difficult for groups of investigators to systematically explore critical issues.

Reform and Simplistic Conceptions of Teaching

As Good (1983) and Good and Biddle (1988) argue, most educational reform movements in the United States have concerned single variables or clusters of variables focused on only one problem of schooling and have not been based on research. The general assumption appears to be that there is a common problem; therefore, there ought to be a simple solution. At various times, educators in this century have advocated as answers large-group instruction, small-group teaching, and individualized teaching (Good & Biddle, 1988)! Similarly, both direct instruction and discovery learning have been cited at different times as means for improving education. Unfortunately, this logic defies experience as well as results of research. The problems of U.S. schooling vary from school to school (Good & Brophy, 1986; Good & Weinstein, 1986), and research has shown that even teachers at the same grade level in the same school may have different problems. Thus, if some classrooms have too much structure and other classrooms have too little structure, then a simple call for more time-on-task will produce uneven effects.

Simple characteristics of instruction have never predicted student achievement, althougn many reform efforts have focused on such characteristics (Good, 1983). The important issue is not whether individualized instruction, small-group instruction, or discovery learning is emphasized but rather the quality and the fit of planning and instruction to each child's and community's needs. Moreover, defining instructional quality requires observation of classroom teaching.

In the past few educational researchers observed teaching (Dunkin & Biddle, 1974), although it seems advantageous to conduct observational

research before curriculum reform is undertaken so that data can be integrated into the design and the testing of alternative solutions to educational problems. Observational research should also be conducted after reforms are implemented to establish the effects of reforms (Good & Biddle, 1988). Unfortunately, until recently, when educational research began to include observational measures, research usually followed rather than preceded educational innovations. Too often reform has also proceeded without meaningful involvement of teachers, that is, the impetus for change came from external sources.

Inadequate Funding for Research

A major reason that there was so little observational research was the inadequate funding for educational research. Conducting observational research is labor-intensive and hence expensive. Complex coding systems need to be developed, coders must be recruited and trained, and analyzing classroom data requires professional expertise. Unfortunately, the low priority assigned to educational research has resulted in the allocation of too few funds to allow systematic, sophisticated research and development. The federal government has been -- and continues to be -- unwilling to pay for educational research (Finn, 1988; Shavelson & Berliner, 1988).

Compared to funds for research in business and defense, the money assigned to educational budgets reflects little political support for educational research. From my perspective, this means that educational research is seriously underfunded. The development and implementation of high-quality, innovative educational ideas are severely limited. According to Futrell (1986), the federal government includes $61 billion

for research and development in its fiscal 1987 budget. Of these funds, .2% is allocated for educational research. In comparison, 61.2% will go for military research, 9.3% for health studies, 8.1% for energy research, and 6.6% to NASA. As Bruce Biddle and I note elsewhere (Good & Biddle, 1988), the Office of Research in the U.S. Department of Education, which is responsible for federal research, presently has a research budget of roughly $47 million. Of these funds, only $500,000 are now said to be available to support new lines of inquiry. The paucity of funding is seen perhaps more clearly when one considers that the present "fly-away" cost of a single B-1 bomber is $212.5 million (Good & Biddle, 1988). Furthermore, a new B-2 bomber costs about $515 million.

Other scholars also lament the inadequate funding for educational research. According to Shavelson and Berliner (1988), "As the nation began to worry about an AIDS epidemic, $252 million was allocated for research. In fact, we see 6.2 billion federal dollars spent each year for medical research in general. When a national need was sensed recently, the government quickly responded by investing $8 million for superconductivity research. Yet when this administration discovered a national crisis in education based on dozens of reports that documented serious problems with the nation's schools, the funding for educational research decreased! While 15% of the federal dollars that go to defense are used to support research, only 0.1% of the federal dollars spent on educational programs are used to support research (p. 11)." Many believe that developing a body of technical knowledge about education and teaching is not important. Although society views investments in medical knowledge as necessary, there is virtually no interest in educational research.

Despite the unwillingness of American educators to spend money for research and development, an examination of the annual reports of most American businesses reflects a pride in investing in research. For example, in the 1988 annual report of the Eli Lilly and Company (Excellence in the Life Sciences) the company announces plans for a new $110 million research center and that it had otherwise increased its research and development budget by 16% -- over the previous year --to $541 million. Similarly, Pfizer's 1988 annual report (Building Shareholder Value Through Innovation) indicated that the company had increased its research and development expenses in 1988 by 18% -- to $473 million. Further, the company announced an increase in its research investment in 1989 by a similar amount (i.e., 18%).

This lack of willingness to invest in educational research has important consequences. For example, Slavin (1987, 1989) contends that it is extremely unfortunate that after 21 years of Title I/Chapter I (more than 45 billion dollars), there has been little careful research on the effective uses of Chapter I funds. Thus, we know little about what takes place in those programs and whether or not they are effective. As a result, we do not know how to address the needs of students at risk of school failure.

The public continues to be willing to spend money on education, and, according to Colvin (1989), educational spending has increased substantially since 1983 -- nearly 25% in real terms. However, distressing evidence continues to mount that the federal government is unwilling to fund systematic research that might provide a basis for the wise spending of new funds to improve schooling.

This unwillingness to invest in educational research is evidenced in several ways. For example, consider the decline of the budget of the federal office charged with promoting and coordinating educational research. In 1973, the newly-created National Institute of Education had a budget of 135.8 million dollars. The congressional funds that were authorized amounted to 103.1 million, and an additional 32.7 million dollars were transferred to NIE from other federal educational budgets. Of that 135.8 million, the following allocations were made in 1973: research and development centers, 19.1; regional laboratories, 22.5; ERIC, 3.9; other, 79.2; and field-initiated research, 11.0. In contrast, the OERI research budget for 1989 shows a dramatic decrease. In the present budget year, 47.1 million dollars are allocated for the research function of OERI. Of these dollars, 17.8 million are allocated to research and development centers, 22.1 million to labs, 5.7 million to ERIC, 500,000 for field-initiated research, and the rest were spent on "other." When we control for inflation, it is clear that the budget of OERI would have to be increased by roughly 600% to match the available funds for research and development activities that were offered to it in 1973 (see Statistical Abstract of the United States for relevant information about rate of inflation). The need for systematic research on educational issues has not declined. Policymakers appear to have been willing to spend 45.1 billion dollars on identifiable programs without a clear commitment to research and development that could indicate whether the programs are useful. Others have also concluded that reduced funding has lowered the quality of information about education (see recent report from the United

States General Accounting Office entitled Education Information, November, 1987).

Beliefs bout the low value of research knowledge in education restrict teachers' professional activities. Knowledge production, at least in public schools, is not expected. Further, faculty in colleges of education are rarely rewarded primarily for research and scholarship.

Society is ambivalent towards educators. The public consistently professes that schools are keys to society's economic and social security. However, they seldom support educational funding designed to study carefully long-term strategies for improving schooling. The public's demand for accountability, coupled with inadequate long-term funding for research and development, pressure many educators to promise that they will do more in the short run than they can conceivably accomplish. They tend to be overly optimistic about research and new educational products (e.g., new curricula). Educators and researchers are reluctant to acknowledge that no educational program is ideal for all students because schooling is a multifaceted process that is affected by many variables (as is the case in many research areas ... see Thomas, 1980, for an eloquent discussion of what is unknown in medicine). Perhaps because of this pressure educators are prone to move from fad to fad in search of new solutions (see Good & Biddle, 1988). However, exaggerated optimism about short-term accomplishments inevitably leads to a mismatch between what is expected and what is actually accomplished and to a further erosion of public confidence in the ability of educational research to play a useful role. Attractive but overly ambitious plans may be a good tactic for securing short-term funds for program improvements, but this strategy

eventually leads to anxiety about the original investment, disenchantment with results, and a growing unwillingness to provide long-term funding for educational research and development. It is time to recognize that complicated problems that took years to create may require a decade (or decades) or educational research and development. For example, it seems unreasonable to expect educators to transform learning environments in inner cities -- even when they have new resources with which to respond to the problem -- when there is an inadequate knowledge base about learning conditions in those settings. If we are to improve public schools, we must recognize the need to conduct long-term basic research. This responsibility falls to individual researchers as well as to institutions that conduct research and development.

In addition; policymakers need to better recognize the conditions under which educational research will be successful. In this sense, those who advocate research can prepare policy documents that encourage researchers to submit proposals for long-term funding of research that builds on basic knowledge in the field rather than studies that promise unrealistic responses to complex problems quickly and inexpensively.

Increased Interest in Observational Research

Although funding for educational research remains low, during the past 15-20 years there has been a growing recognition of the importance of research that examines classroom processes. Researchers from a variety of disciplines, using different methodologies (i.e., both quantitative and qualitative) have made observational research a valued activity. Even though this type of research is expensive, its growing importance has led researchers to move from surveys to actual examination of classroom

practice. However, even today, classroom observation continues to be the exception rather than the rule (it is simply less of an exception than it used to be!).

Among the numerous factors that led to increased observational research in the 1970s, two are of major importance. First, research syntheses published in the mid-1970s (e.g., Dunkin & Biddle, 1974) signified the need for observational data collected in particular contexts as a prerequisite for describing and understanding instructional effects. Another major factor was the increased involvement and interest of federal agencies, particularly the Office of Education's funding of evaluation studies such as Project Follow-Through and the National Institute of Education's funding of several large-scale field studies that involved classroom observation (for more discussion on the development of the field, see Brophy & Good, 1986).

The opportunity to collect observational data led to an explosion of interest in variation among classrooms in U.S. schools. Many had criticized schools in the 1960s and contended that the variation in instruction between and within schools was minor. Preliminary results, however, indicated that there might be more variation than previously anticipated; hence, many researchers began to observe classrooms.

Although the movement of research into classrooms may seem but a small step, technical knowledge is necessary to describe teaching and classrooms. Unfortunately, as late as 1975 there was little systematic knowledge about classrooms as social organizations and learning environments.

Knowledge from Recent Research

The field has made good progress in the past two decades (for reviews see Brophy & Good, 1986; Good & Brophy, 1987; Shulman, 1986). As Brophy (1968) notes, two decades ago when teachers raised questions about classroom management, they were offered vague and often conflicting advice from research. That advice typically was not based on systematic research in classrooms. There were only scattered results that did not form interpretable patterns. However, research on classroom organization and management in the past 20 years has produced consistent and useful knowledge that offers general principles and knowledge that teachers can use in developing classroom environments in which students are appropriately involved. Today, the field possesses replicated correlational findings and process relationships that have been validated in field experiments (see Gage & Needles, 1989). The development of a technical culture and associated specialized knowledge is evident not only in the area of classroom management but in many other areas as well (e.g., students' knowledge and conceptual change, teachers' planning).

Quantity of instruction. It is beyond the purpose of this paper to review this literature in any detail (interested readers can see Brophy & Good, 1986). However, it seems appropriate to summarize some of the major results of this research. The most consistently reported findings concern the quantity of academic instruction that teachers provide. Many studies have demonstrated that amount learned is determined in part by opportunity to learn (exposure to relevant content), which is determined by four broad teacher behaviors. First, the extent to which teachers are businesslike and task-oriented, emphasize instruction as basic to their role, expect

students to master the curriculum, and allocate most classroom time to those activities that have relevant academic objectives is important. Second, teachers whose students make reasonable academic progress frequently use classroom organization and management strategies that maximize the time students spend engaged in academic activities. Third, effective teachers allow students to move through the curriculum briskly but also relatively successfully. Fourth, these teachers were found to spend most of their time actively instructing their students in group lessons or supervising their work on assignments rather than allowing students to spend inordinate time on individual seatwork practice without supervision or feedback.

Quality of instruction. There are also findings about the quality of instruction. In particular, student achievement is enhanced when teachers' presentations and/or demonstrations include sufficient enthusiasm, clarity, logical sequencing of content, and structuring of the content in ways that help students to recognize it as an integrated whole. Thus, through using advance organizers, outlining, and calling attention to main ideas, teachers help students to see and appreciate the relationships among parts of a lesson and/or how concepts might be interrelated (for greater elaboration see Good & Brophy, 1987; Slavin, 1989). Much contemporary work is focused on the quality of teachers' subject-matter knowledge and pedagogical content knowledge (e.g., Shulman, 1987).

The technical culture now extends well beyond the process measures associated with students' performance and the traditional content measures. Contemporary work is enhancing knowledge of how students make

progress in problem solving and develop higher-order thinking skills (Porter & Brophy, 1988). Subject-matter knowledge -- and how to structure classrooms to enhance advanced subject-matter learning -- is getting increased attention (Richardson-Koehler, 1987).

A comparison of the knowledge of schooling 2 decades ago with contemporary knowledge shows that extraordinary progress has been made in understanding classroom instruction and learning. For example, 2 decades ago there was no literature on the communication of expectations in classrooms. In the ensuing 20 years considerable progress has been made in conceptualizing and understanding how teachers might communicate differential performance expectations to students under the complex constraints of classroom teaching (e.g., Good & Brophy, 1987). Twenty years ago there was no systematic information available about classroom management. In the literature of the late 1960s there was no emphasis on proactive management, a concept that Kounin introduced in 1970. Comparing the literature on classroom management in 1968 with Doyle's (1986) integrative review, one can readily ascertain the important progress that has occurred in terms of the level of concepts and findings that are presently available in this area. Two decades ago there was only fledgling work in cognitive science, with an emphasis on classroom application. Enormous strides have been made in this area (e.g., Resnick, 1983). Numerous other examples could be cited to vividly illustrate how much more is known about classroom teaching presently than was the case 2 decades ago (see for example Brophy, in press; Pearson, 1984; Richardson-Koehler, 1987; Slavin, 1989; Wittrock, 1986). Modern research focuses not only on interaction in the classroom (which dominated the work of the

1970s and early 1980s) but also examines the presentation of subject matter, the core issue around which much classroom interaction occurs. It is evident that new advances are occurring in basic curriculum areas such as mathematics, reading, writing, and science, and that students are now characterized as active learners in a complex social setting (see for example Anderson & Smith, 1987; Confrey, 1987; Corno & Rohrkemper, 1985; Florio-Ruane & Dunn, 1987; Mergendoller & Marchman, 1987; Raphael, 1987; Wittrock, 1986).

Recent Advances in Research on Teaching

Various sources document recent improvements in research on teaching (Brophy, 1989; Brophy & Good, 1986; Clark & Peterson, 1986; Slavin, 1989). As previously noted, research in the 1970s provided a foundation linking classroom processes to student achievement. This research made it undeniably clear that teachers make a difference in students' learning and yielded several instructional models (e.g., active teaching, communication of expectations, etc.) that identified some of the ways in which teacher behavior influences student achievement (Good & Brophy, 1987).

However, several characteristics of this research limit its application. Perhaps the major problem was that these studies initially intended to establish that teachers affected student learning, not to explain theoretically how teachers had an effect. This research yielded information about effective teaching, but only concerning certain, fairly general, teacher behaviors. The data base is therefore probably sufficient for making gross distinctions among teachers -- for identifying teachers who do not have the necessary minimum skills for organizing and

implementing instruction, but it cannot distinguish average teaching from truly outstanding teaching.

More comprehensive. Several changes have occurred in the field in the attempt to study qualitative aspects of teaching more thoroughly. Brophy (1989) notes that in the 1980s classroom researchers focused more on particular curriculum units, sometimes even on individual lessons (or concepts), and on teachers' instructional objectives (their beliefs and intentions) in addition to their instructional behavior. Indeed, the shift in focus in some cases was so drastic that researchers substituted one set of design problems for another. That is, researchers explored more comprehensively the mental lives of teachers but ignored how teachers implemented lessons. In addition, there was a growing insistence among researchers that students' learning be considered in terms of problem solving and higher-order thinking as well as the mastery of basic facts. Rather than measuring student performance only on criterion-referenced or standardized achievement tests, researchers interviewed students to assess their ability to explain key constructs in their own language and to apply that information. Studies also examined students' views, or attitudes, about learning.

Active student learners. Recent research also examines active student learning as well as active teaching (e.g., Swing & Peterson, 1988). Studies conducted in the 1970s established that active teaching, for example, clear expectations and modelling of problem solving, facilitated student learning. Research in the 1980s shows that students need opportunities to ask questions about relevant content, think critically, and apply information. Thus, much recent research attempts to

explain how the social settings of classrooms affect students' understanding of subject matter.

As Brophy notes, many current researchers support a theory of learning that has been influenced by the information-processing approach to human cognition. This approach emphasizes the important student learning goals that teachers must accomplish as well as teachers' ability to communicate knowledge actively and clearly. Moreover, information processing holds that teachers must be concerned with students' current knowledge and with the information processing and conceptual change required to enable students to reach learning goals. Teachers should allow students progressively more opportunity for integrating and controlling their own learning.

Unfortunately, little classroom research has focused on how assignments should be designed and implemented to encourage independent learning. More research needs to examine students' motivation to learn and their willingness to notice and to attempt to clarify differences between their current knowledge and new information. Indeed, there is some evidence that many students are not actively engaged in acquiring new information; they passively attempt to understand what the teacher wants and then memorize facts (see for example Good et al., 1987; Goodlad, 1984).

Teachers' subject-matter and pedagogical content knowledge. Perhaps the most dominant focus in current research is the distinction between teachers' subject-matter knowledge and pedagogical content knowledge. Subject-matter knowledge involves teachers' understanding of a particular subject (e.g., biology), whereas pedagogical content knowledge concerns

teachers' ability to identify from the knowledge they possess about a subject those ideas that are important to teach to students at a particular grade level. This includes communicating or structuring learning activities so that students can understand and interrelate key ideas. Much important research is examining what subject-matter knowledge and pedagogical content knowledge teachers need to enhance student learning (see for example Brophy, in press; Carpenter et al., 1988; Peterson, Fennema, Carpenter, & Loef, 1989).

Teachers' subject-matter and pedagogical content knowledge are likely to have important consequences for student learning. Some teachers are relatively ineffective because their subject-matter knowledge is low. Moreover, teachers may be relatively high in some subject-matter knowledge but relatively low in other knowledge (language arts vs. mathematics). However, what distinguishes new research is its focus on the extent to which teachers use knowledge (i.e., transform subject-matter knowledge into pedagogical content knowledge). According to Brophy (1989, p.5): "Where their knowledge is more explicit, better connected, and more integrated, they will tend to teach the subject more dynamically, represent it in more varied ways, and encourage and respond fully to student comments and questions. Where their knowledge is limited, they would tend to depend on the text for content, deemphasize interactive discourse in favor of seatwork assignments, and in general portray the subject as a collection of static factual knowledge." Some studies suggest that teachers are more flexible when teaching a subject that they are highly knowledgeable about than when presenting content about which

they are less knowledgeable (e.g., Duffy & Roehler, 1989). However, much more empirical work needs to be done in this area.

To summarize, some exciting concepts and theories about teaching that facilitates students' conceptual understanding are beginning to emerge. For example, many classroom researchers argue that teaching for understanding involves not only asking students to supply relevant facts (a traditional focus) but also structuring learning activities so that students must offer explanations and defend their thinking. There is a growing belief that students must engage topics more meaningfully, use their own language to describe concepts, and apply subject-matter knowledge to problem-solving situations. However, some teachers who can achieve these student goals may still be hampered because they do not have a well-developed understanding of domain-specific knowledge about many of the topics they teach. They may recognize that they need to explain certain topics or integrate certain concepts, but they may need additional subject-matter knowledge before they can do so. Other teachers may have excellent subject-matter knowledge but lack the disposition or the pedagogical content knowledge necessary to teach it meaningfully.

Teachers' belief systems. It is ironic that contemporary and comprehensive studies of pedagogical content knowledge, which involve careful examination of various teacher beliefs about instruction, indicate that many other teacher beliefs control how teachers use their subject-matter knowledge. Teachers' beliefs about equal opportunities for students to respond, their expectations for students' general performance, and their views of how students learn may be as important -- and in some cases more important -- than their simple pedagogical content knowledge.

Researchers must integrate pedagogical content knowledge with other forms of pedagogical knowledge, including teachers' beliefs about teaching as a profession, how students learn, and the goals that are perceived to be important in a particular school, in order to understand how teachers influence students' learning.

Use and Misuse of Classroom Research

Unfortunately, many practitioners and especially policymakers believe that recent classroom research suggests that competent teachers only need good communication skills. Unfortunately, policymakers use limited knowledge from the technical culture in a controlling, rule-governing, bureaucratic fashion. I believe that technical knowledge needs to be adjusted to particular settings use controlled by teachers' professional discretion and decision making. As Catherine Mulryan and I argue (Good & Mulryan, in press), successful teaching involves more than effective communication (appropriate pace, clarity, good use of examples). It also entails the application of principles of cognitive development (e.g., preoperational students need numerous concrete examples, formal operational students can work with abstractions), understanding of human motivation, knowledge of subject matter, as well as pedagogical skills necessary to help students to understand the curriculum. Although recent research is valuable, it yields only limited information about the full range of knowledge, dispositions, and skills that teachers need if they are to be successful in the classroom across several student outcomes (Brophy, 1988).

School Research

There is now considerable research showing that the school students attend can make a substantial difference in their education (Brookover et al., 1979; Edmonds, 1983; Good & Brophy, 1986; Good & Weinstein, 1986; Purkey & Smith, 1983; Rosenholtz, 1985; Rutter, 1983; Wimpleberg, Teddlie, & Stringfield, 1989). It is beyond the purpose of this paper to review this literature in detail; however, it is appropriate to consider briefly some of the broad findings from this research.

General findings. Edmonds (1983) contends that the characteristics of effective schools are (a) a pervasive and broadly understood instructional focus; (b) an orderly, safe climate conducive both to teaching and learning; (c) leadership of the principal reflected by continuing attention to the quality of instruction; (d) teacher behaviors that convey an expectation that all students are to achieve at least minimum mastery; (e) the use of measures of pupil achievement as the basis for program evaluation. In general, most of the early research on school effectiveness centered on general characteristics believed to distinguish more productive from less productive schools, with school outcomes being measured in relatively narrow ways. However, some of the school effectiveness research suggested that the "parts" somehow "came together" in effective schools. For example, Rutter (1983) reports that the correlation between the combined measure of overall school process and each of the outcome measures (attendance, achievement, student conduct) was much stronger than was the correlation between any single process variable and outcome measure. This empirical finding implies that various

social factors may combine to create a school ethos, or a set of values and behaviors that characterizes a school.

New data. Unfortunately, because of the paucity of research funding, there has been relatively little new, basic research on effective schooling in the past few years. However, some new and, I believe, useful research provides data and subtle caveats about the important role of context in defining effective schools, even when definitions of "desirable outcomes" are held constant (e.g., Hallinger & Murphy, 1986; Mortimore, Sammons, Stoll, Lewis, & Ecob, 1988; Teddlie & Stringfield, 1985). It is beyond the purpose of this paper to review this evidence; however, recent work provides clear evidence that what constitutes an effective school depends on school context (see also Teddlie, Stringfield, Wimpleberg, & Kirby, 1989). In addition to new context data, there is also information about qualitative aspects of classroom organization and teaching that appear important if effective learning is to occur.

Evidence on school effectiveness continues to grow. Mortimore et al. (1988) studied 2,000 pupils as they moved through 4 years of classroom life (from ages 7 to 11). They collected data in 50 junior schools randomly selected from the 636 inner-London schools. Numerous factors were found to differentiate effective schools from schools that had fewer effects on student achievement. Here I will comment on only three of those factors -- structured lessons, intellectually challenging teaching, and maximum communication between teachers and students.

Results indicated that the best classroom teachers exhibited a reasonable degree of structure but provided some freedom for pupils within a well-defined framework. Effective teachers had some organizational

flexibility in beginning and ending lessons were able to vary lesson activity, to some extent, in order to maintain student motivation. This finding suggests that teachers must learn to use different instructional models rather than depending too much on a single model. Obviously, teachers who continue with one format too long will find it difficult to maintain the maximum motivation for all students.

In effective classrooms teachers more often used higher-order questions and statements and they encouraged students to engage in problem solving. Teachers were willing to challenge students' preconceptions and required them to think about content. Furthermore, teachers in effective schools created an interesting context for learning by expressing their own interest and enthusiasm and explaining the purpose and the value of subject matter.

The data indicate that pupils gained from having many opportunities to communicate with teachers. Some teachers spent most of their time speaking to individual students; in these classes each student could only have limited contact with the teacher. In contrast, other teachers communicated with entire classes. The researchers do not argue that teaching should be whole-class; rather, they support a flexible approach. They note some teachers had individualized classes to such an extent that there were little important communication among teacher and students. In such classes teachers seldom modeled a process (or had students model) or structured issues before assigning students to work individually or in groups. Effective teachers had at their disposal a repertoire of instructional approaches that allowed them to communicate effectively with the whole-class, with small groups of students, and with individual

students. They could present higher-order information to students in a stimulating way.

Again, these data suggest how easy it is to confuse the form of instruction and its quality. Many reform advocates inappropriately conclude that because much instruction that is boring and focuses on low-level skills occurs in a whole-class format, a change to another organizational format will solve the problem. Mortimore et al.'s data suggest, however, that how a format is used is the critical issue.

School context. Like many other "effective schools" researchers, Hallinger and Murphy (1986) note some striking similarities between effective high-and-low-SES schools: for example, a clear mission, instructional leadership, a safe and orderly environment, high expectations, and a well-coordinated curriculum. However, they found important differences in effectiveness as a function of school setting. For example, the alignment of the curriculum with instruction in low-SES schools was moderate but in high-SES schools it was very close. In contrast, principals' control of instruction in low-SES schools was high but in high-SES schools it was low to moderate.

Hallinger and Murphy argue that effective schools take the learning abilities and needs of their students into account when they develop curriculum. They note the high-SES schools had greater pressure to instruct in all areas in which students were tested, and thus there was close alignment between instruction and testing. Interestingly, in one low-SES school, teachers pointed out that during the previous year students had scored poorly on one mathematics topic but the teachers decided not to direct instruction to that area so that they could maintain

high achievement in other areas. Thus, some implications from school-effectiveness research (e.g., teach all areas covered on a test equally) may not be applicable in some contexts, for example, where students need time to understand rather than to cover more content.

In terms of control of instruction, principals in effective low-SES schools maintained relatively tight control, directly selecting and implementing curriculum and instructional programs. Although principals in effective high-SES schools frequently visited classrooms and coordinated school-wide curricula, these principals controlled classroom instruction less and generally allowed teachers to make decisions about how to achieve agreed-upon student goals.

Teddlie, Stringfield, Wimpleberg, and Kirby (1987) also report various differences between effective low-SES and effective middle-SES schools. For example, teachers in effective middle-SES schools contacted parents more frequently and believed that parents were highly concerned about the quality of their children's education. However, teachers and principals in effective low-SES schools did not perceive parents to be involved with the education of their children and initiated relatively little contact with parents.

It is beyond the purpose of this paper to discuss context comprehensively. However, there is growing evidence that variables that seem important in one setting are not critical in other settings. Brophy & Evertson (1976) illustrated some time ago that appropriate instruction varies in classrooms serving different types of students. Recent research has extended this qualification to variation in school context.

Wimpleberg, Teddlie, and Stringfield (1989) argue that context can include socio-political variables such as "...the socioeconomic background of the students, governance structures that determine fiscal and operational decision making, grade levels (age of students and curriculum program of the school, and more" p. 82). In the 1990s I believe that context will be defined in more dynamic ways. For example, two schools might be populated by students from a low-socioeconomic background, but one school may be located in a district that contains a core of college-educated individuals who have moved back into an urban area and in the other district no such resources may be available. In another school area there may be a grass roots movement of citizens who, although not college educated, have high expectations for what schools can accomplish and can provide considerable resources for schools. In some schools responsive staffs are ready to work with concerns of committed parents; in other schools the teaching faculty may be part of the problem. Perhaps one of the core issues for researchers in the 1990s will be to integrate the need to produce generalizable concepts and useful analytical frameworks with the fact that each classroom is unique (Rohrkemper, personal communication).

It is easy to trivialize context and to interpret it too narrowly in terms of grade, student SES, or other classificatory variables. It is clear that beliefs and perceptions that teachers and learners bring to the classroom, the assignments students receive, and the language they use at home (and on the playground) are all important aspects of context that must be considered in estimating the generalizability of empirical findings. Although recent classroom and school research have further

sensitized educators to this context, one pressing issue is the need to conceptualize more powerful ways for describing learning contexts. The ultimate goal is to achieve the match between the individual learner and the curriculum that will lead to the most productive and mindful learning. Although we have made some important progress in studying context, our ability to describe the needs of individual learners in particular settings is very limited. The caveat here is that even if one matches the context of the research report (e.g., low-SES classrooms) with the appropriate practical setting (e.g., low-SES classrooms) it is important to acknowledge and to accept the limitation that research that focuses on "average students" may make egregious errors when trying to specify the learning needs of individual students.

As Doyle (in press) argues, understanding how meaning is created in a classroom context requires a sophisticated and well-developed language for describing teachers' and students' interpretations of classroom events as well as events per se. In the 1980s researchers have made considerable progress in describing classroom events (behavior, tasks); in the 1990s we must further analyze participants' perceptions of schooling. Descriptions of both dimensions are necessary if we are to understand classroom contexts; clearly, classrooms can and do differ on both dimensions. For example, study of how teachers communicate expectations is important; however, the extent to which students perceive expectations is equally important.

Theory. One of the emerging emphases in the effective schools literature is a focus on theory. For example, work by Rosenholtz (1989) provides clear evidence that the normative culture varies in more and less

effective schools. In a real sense, Rosenholtz's work brings into the "context" discussion the beliefs and dispositions of teachers. She found that teachers in effective schools had shared goals about what was important and had the chance to collaborate with other teachers and to continue their own learning. In effective schools, teachers saw that working with others reduced their uncertainty about school practices and increased their classroom success. Rosenholtz noted that teachers' certainty about a technical culture and their own instructional practice was an important construct. As teachers developed greater certainty about instruction and further developed their technical knowledge, they seemed willing to search for reasons and ways to help students rather than looking for excuses for failure. She notes that teaching was always difficult and that there were many uncertainties and problematic aspects associated with it.

Rosenholtz found that some schools tended to conceptualize teaching as routine and other schools viewed it as nonroutine. In schools that looked at teaching as routine, teachers tended to work alone, with only their own observations and habits on which to base reflection and growth. In schools that saw teaching as more nonroutine, there were more attempts to gain and share technical knowledge about instruction.

According to Rosenholtz, "...ambiguous goals, unclear, infrequent evaluation, and a lack of common purpose lead to greater instructional uncertainty and, at the same time, grant teachers wide latitude to define and independently pursue their own goals. In other words, goal multiformity encourages norms of self-reliance and, as a consequence, professional isolation from colleagues. The absence of professional

interaction, of substantive dialogue about their work, carries profound implications: individuals may come to perceive that comparatively few colleagues suffer similar uncertainties about teaching, that they endure fewer instructional problems; and that if others experience few problems, there is embarrassment in admitting one's own. Thus, to protect their self-esteem in isolated settings, colleagues neither ask for nor expect any help, and cannot be imposed upon by others. In collaborative settings, on the contrary, teaching is defined as an inherently difficult undertaking; one that challenges the best of teachers. And if even the most capable teachers need help in similar situations, there is little reason to question one's own sense of professional worth. Stated differently, the less ego-endangering teachers' workplace circumstances, the more they will request and offer advice and assistance to accomplish agreed upon goals" (p. 6).

Psychic rewards played an important role in teachers' certainty about instruction. If principals, colleagues, students, and parents gave teachers positive feedback about their work, their uncertainty diminished.

Rosenholtz argues that teacher commitment was present in many schools to the extent that they had shared goals, learning opportunities for teachers as well as students, task autonomy, and psychic rewards from their work. Teachers in less effective schools were more interested in freedom <u>from</u>; they thought little of freedom <u>to</u>. In my opinion, the most important result of Rosenholtz's study is a coherent, integrative analysis of how the social organization of schools influences perceptions and behavior of school staff in ways that either enhance or reduce the quality of classroom teaching.

Abuses of research. Rosenholtz (1989) notes that although research on successful school practices offers clear evidence that schools affect student achievement, the potential of any strategy to enhance student performance is heavily influenced by the context in which schooling occurs. Thus, there is no easy formula for school improvement -- only guidelines and concepts that educators can use in planning improvement programs. Despite careful critiques pointing out the limitations of school research (see, for example, Good & Brophy, 1986; Good & Weinstein, 1986), many districts are attempting to apply the results of school-effectiveness research in order to improve student performance. Unfortunately, many of the prescriptions and formulae for effective schools are exceedingly narrow and undermine rather than enhance teacher creativity. Many school reform plans appear to be uninformed by evidence that the social context of a school is a key factor in planning school reform (e.g., Hallinger & Murphy, 1986).

Common Weaknesses in Classroom and School Research

Now that researchers have clarified that schools and teachers make a difference, it is important to explain more completely how processes at both levels operate and how they can be combined. Researchers should not only examine school practices (e.g., school rules) or classroom assignments (e.g., the extent to which instruction emphasizes rote learning or meaningful learning) but should also study how the effects of one teacher can be combined with the effects of other teachers in ways that do not threaten teacher autonomy yet make schooling more coordinated and effective for all concerned.

Another common weakness of research at both the school and classroom levels is that the relations examined involve student achievement as measured by standardized achievement tests. However, as Rhona Weinstein and I argue (Good & Weinstein, 1986), in addition to measuring interpretive knowledge, schools need to broaden and diversify what they teach students in the various content areas. For example, many process studies show that mathematics is taught as a means of producing exact answers. Too little time is spent on mathematical problem solving or on using mathematics for estimation and for dealing with uncertainties, despite the fact that much of our society's application of mathematics involves such activities. Other scholars also point to the need for schools to broaden their outcomes (e.g., Goodlad, 1984; Rosenholtz, 1989).

There is growing recognition that researchers need to attend to both school and classroom processes. Part of the research agenda for the future is to examine processes that facilitate instruction both in the classroom and in the school at large. Some decisions concerning the allocation of resources may improve both, but others may lead to an overemphasis at one level that erodes teacher autonomy or does not yield coordination between school and classroom resources. Weinstein and I believe that differences in teaching styles are not only inevitable but often have positive effects on students. Thus, attempting to balance school and classroom concerns is not an argument for teachers in the same school to use similar styles and practices. Rosenholtz (1989) provides data that demonstrates that individual teacher autonomy and a shared direction for the school can co-occur. Indeed, her data suggest that both

dimensions must be present if teachers are to feel intellectually challenged and supported in their school settings.

The idea of teachers exchanging ideas and improving instruction is not based on the notion that teachers will imitate a particular teacher or a program goal. Rather, if schools are to affect student outcomes significantly, teachers must be cognizant of how other teachers in the same school teach, including teachers at other grade levels, and know how to use other teachers as resources (Good & Weinstein, 1986).

Teaching as Professional Activity

It is beyond the scope of this paper to review the literature on teaching as professional activity. However, as I have noted elsewhere (Good, 1989), there is increasing evidence that many teachers are dissatisfied with the conditions in which they work. For example, in a study conducted in 1988 by the National Education Association, many teachers reported dissatisfaction with their involvement in decision-making. Ninety-four percent of the teachers indicated that they should have some say about other teachers who are hired, 88% indicated the need for an active voice in standardized testing policies and procedures, and 82% wanted more opportunity to discuss budget issues. Given these teacher beliefs, there is growing recognition of the need to allow teachers more opportunity for significant involvement in school management. If teaching is to be a profession, teachers need some opportunity to influence the conditions of teaching.

Freidson (1984) contends that it is not necessary to speak of deprofessionalization as long as the formulation and direction of professional work remain in the hands of members of the profession.

However, in certain professions in which workers make the putative claim to be professionals, this issue of control is extremely problematic. Increasingly, the control of education is in the hands of members of state boards of education or state departments of education, although their formal connection to university faculty members, public school teachers, and educational researchers is often remote at best. The argument that members of the education profession are controlling the direction of the profession is therefore extremely problematic and in many cases erroneous.

Decisions about standards of curriculum and pupil performance are increasingly made by individuals who have little understanding of student cognition and development, formal knowledge of subject matter, and insight into instructional process linking students and subject matter in integrative ways (i.e., sophisticated decisions about what subjects and instructional methods are appropriate for particular students). Even though our technical knowledge of teaching is expanding and it is the case that we understand better the degree of integration of knowledge that must occur if teachers are to enact curriculum meaningfully (e.g., Doyle, in press). Teachers' and schools' capacity for decision making is being diminished by external influences.

Ironically, schools' inability to function professionally and productively is at least partly to blame for external constituencies' demands (and legislation) for reform. It was not an arbitrary public that demanded that school principals be trained in financial and bureaucratic ways, which left them largely uninformed of major advances in curriculum and instruction. That is, principals' low level of concern

with critical issues of instruction and curriculum is due in part to decisions by many local school boards, who value orderly and smooth-functioning schools. Teachers, as a professional group, have been remiss in asserting the joint ownership of the curriculum with lay boards. All too often, teachers' expertise and knowledge of instruction has been ignored in favor of the opinions of lay boards and administrators who are far removed from advances in the field.

Thus, there seems to be a lack of normative beliefs about the value of a technical culture and unwillingness to spend resources to advance the technical culture (and challenge extant practice) in most school districts. It is altogether fitting to assert that federal funds for educational research have been inadequate. However, it is also important to recognize that school districts largely refuse to invest in research and development activities that have enormous potential to enhance teachers' technical knowledge. The call here is for school districts to invest more in small-scale research and development ... large-scale research I would see as a federal responsibility.

Two other factors have also limited educators' ability to be treated professionally. First is the fact that there was essentially no knowledge base until recently, and even now there is a very limited one. It is also the case that many teachers and principals are ill-informed about even the small knowledge base that exits. Until both groups have the opportunity and begin to act more as professionals, they are unlikely to be treated as professionals. Professionals or teachers who are too busy to read are not professionals.

Changing school structure. One of the obvious reasons for jointly considering school and classroom variables in research as well as policy is that many changes that are necessary in classrooms -- especially those designed to professionalize teaching -- can only occur if structural changes are made in schools. For example, Romberg (1988), contends that for teaching to become a profession, it will be necessary to make it a full-time job. He notes that the United States is the only first world country that hires teachers for 9 to 10 months. He further notes that class loads must be reduced if teachers are to have time to reflect, to plan, to work with individual students, and to collaborate with peers. According to Romberg, 3 hours a day of instruction are more than sufficient for any professional teacher. Furthermore, master teachers need not meet every class every day for every student activity. If the schedule were so organized and if staffing were appropriately done, master teachers could offer direct instruction only 2 or 3 days a week and other adults could supervise other activities. In elementary schools, meeting classes only on certain days of the week might be disruptive of continuity for both teachers and students. Hence, at the elementary school level it might be more viable to talk about meeting classes for fewer hours during the day. Further, in some school environments it might make sense for more face-to-face instruction than is presently the case. The point is not necessarily that "less" is better (e.g., in Japan teachers engage in more face-to-face instruction) but that we should begin to match instructional time and staffing decisions in terms of the problems and opportunities that are presented in particular school contexts.

Romberg argues that the profession needs a career ladder so that teachers can see a professional future. It makes little sense to give teachers who have taught competently for 10 years the same responsibilities and resources that beginning teachers have. Although one might not agree with all of Romberg's beliefs (e.g., the need for a full-year calendar), he makes a compelling argument that many of the important changes in classrooms require intervention in the schools as well. The structure and the social organization of schools must be altered if classroom teaching is to be improved and, similarly, classroom teaching must be enhanced if schools are to be more productive and stimulating academic environments.

Teacher collaboration. Structurally, schools discourage collaboration and encourage, at least implicitly, isolation. Rosenholtz (1986) argues that several factors can contribute to organizational inertia that characterizes most schools: the absence of performance feedback, a lack of collegial assistance, and limited teacher participation in the development of instructional programs. Rosenholtz (1989) has shown that changes in the social organization of schools can be associated with different norms for peer assistance (e.g., whether it is permissible to seek help or information when one has a problem).

Bird and Warren-Little (1986) note that few public schools sustain strong norms of collegiality and instructional experimentation and that these characteristics are sufficiently clear in these few schools to make their absence in other schools highly salient. According to these researchers, schools organized for continuous improvement will cost more than the schools we have now. However, we will pay more later for failing

to encourage these norms now, and these researchers urge investments that will improve the conditions of teaching. From their perspective, the most important prerequisite for improvement is time with colleagues: time for teachers to study, analyze, and improve instruction. They note that 1 hour a day might be used to support coaching and teamwork to improve lessons, materials, and tests. In terms of providing more time with colleagues, 3 hours could be added to the week, and 2 weeks to the year. It seems evident that collegiality is a characteristic of professional behavior. However, given that the workplace discourages collegial interaction, it seems clear that more opportunity must be provided for teacher-teacher interaction if teaching is to become more professional in nature. However, if teachers are to benefit from this exchange, they must possess an expanded technical knowledge base.

Sykes (1986) notes that school reform is beginning to include an interest in increasing teaching's attractiveness, in enhancing its image as worthwhile, satisfying work. He argues that professional standards rest ultimately on attitudes, beliefs, and actions of teachers. Teachers' commitment cannot be controlled and monitored from without; it must be created from within through work processes in schools, and it rises out of interactions among teachers. Similarly, Darling-Hammond (1986) believes that peer review and control are the central tenets of professionalism. Yet another characteristic of professionalism would be the capacity for self-regulation informed by a professional knowledge base (see Freidson, 1984). Unfortunately then, teaching is seen to be lacking another aspect of professionalism.

Research and shared decision making. Others, too, have lamented the limited role of educational research in educational decision making. For example, Glaser (1984) argues that education is one of the least research-supported professions. Perhaps this is one of the reasons why so little widespread public support exists for paying teachers professional salaries. Further, although good teaching involves considerable art -- and always will -- (e.g., timing, an example that appeals to affective and aesthetic needs as well as cognitive ones), it also represents an opportunity for teachers to provide a basis for shared decision making, an understanding of key issues, and awareness of empirical propositions that have been examined in actual classroom practice (i.e., there is also a scientific basis). As Billups and Rauth (1987) persuasively argue, with only "art" and no "scientific" basis, public acceptance of teaching as a profession is unlikely to occur.

Others have argued for enhancing teachers' professional role by providing research opportunities (e.g., Rosenholtz, 1989; Strickland, 1988). Conducting research should also allow teachers the time and resources to collect and organize data and discuss their implications. Teachers can work in small or large groups as appropriate and can occasionally collaborate with university researchers. What is important is that teachers share ideas, reflect on teaching, and extend their knowledge of alternative practices. However, it is clear that teachers need time if they are to engage in the type of reflective scholarship reflected in the work of practitioner-scholars -- time to make tapes, keep copious journals about certain aspects of teaching, and to share these ideas with colleagues (see for example Lampert, 1985; 1986a; 1986b).

Synthesizing Teacher-Level, School-Level, and Professional Development Research

Research at both the classroom and school levels paints an increasingly complex picture suggesting that successful teaching is associated with numerous variables that can take many forms. Research has moved from a focus on teacher behavior (20 years ago single teacher behaviors were sometimes the subject of investigations) to studying beliefs, intentions, and reciprocal (teacher-student) causation.

It is now understood that the context in which teaching and learning occur is of utmost importance. However, context itself is a complex, multidimensional variable. Context is more than the definition of the student population (e.g., a high-SES setting); it also includes teachers' skills and dispositions about learning and change (e.g., Can some or most teachers in a school appropriately use small-group instructional models when they choose to do so?). In analyzing teaching-learning contexts, the subject-matter knowledge of teachers in a school is important, as are the various beliefs that teachers hold about instruction (e.g., How do they conceptualize mathematics? Does it imply speed and right answers, or the search for patterns and understanding?). School practices and individual students' learning experiences also are part of context (Do students have experience in working in small groups, and what is the nature of this experience?).

Given the complexity of and variation among instruction-learning settings, research findings -- no matter how clear the relevant theory or how robust the findings -- must be interpreted in relation to individual teachers and individual schools. This is not to suggest that concepts

like alerting or wait time have no general meaning; they have significant implications. However, the effective implementation of a concept (e.g., from research on teaching) can take many forms, and a teaching behavior may be appropriate in some contexts but not in others. Even behaviors that have wide applicability are not useful in some schools or classrooms. Teachers must analyze and discuss findings and concepts from research on teaching in terms of their teaching situations.

The argument that teachers must "act upon" research has important consequences for the design of in-service and school-improvement programs. It suggests that school districts should terminate the practice of moving from program to program and looking for "answers" from research. Rather, schools should carefully reflect on their own opportunities, define their own problems, and then identify relevant research and explore actions that the research suggests. Research would stimulate discussion and suggest alternative practices.

The notion of teacher as interpreter and selective user of research provides an intriguing area for subsequent research. Specifically, if more schools used this approach to organizational change, researchers could study how different models work in various types of schools. As I argued earlier in this paper, the quality of a method of organization or a process is much more important than its form. For example, small-group instruction can be used in ways that encourage students to be more passive or more active. The use of this method does not predict students' involvement or the extent to which they examine skills or concepts. Similarly, institutions that allow teachers to reflect on research findings or research educational issues of interest to them would

implement the ideas and opportunities in various ways. Indeed, the use of reflective study teams might control thinking about curriculum reform in overly-rigid ways, resulting in unnecessarily similar instructional approaches. Various structural opportunities (e.g., time for face-to-face dialogue with peer teachers) and resources provided to facilitate teacher decision-making and planning for curriculum reform are significant topics for future research.

There are alternative ways for organizing information for teachers. For example, researchers might summarize what is known about differences in more and less "effective" environments within a particular context so that teachers can consider the value of that information, particularly in relation to their own classes or schools (Good, Grouws, & Ebmeier, 1983). Similarly, teachers can benefit from results of research on student learning in a specific subjects. For example, Carpenter, Fennema, Peterson, Chiang, and Loef (1988) found that knowledge about how students learn basic addition and subtraction was useful to teachers. However, whether the information provided to teachers involves teaching behavior or covert student variables, teachers must be encouraged to "act on" (e.g., evaluate) the information.

Areas of Research that Merit Investments

As I mentioned previously, many potential research topics are not discussed in this paper (teacher recruitment generally or minority recruitment specifically, home-school communication, computer usage, comparative studies, and knowledge utilization studies to name but a few). Further, I want to stress that my intent here is not to order research priorities or to suggest the design for specific studies. Rather, I want

to illustrate some of the many types of research that could -- and I believe that should -- be funded in order to enhance the knowledge base of classroom and school learning. I believe that increasing this knowledge can assist in the design of schools that encourage more reflective and productive performance.

Teacher Research and Scholarship

If educators and policymakers are interested in stimulating school improvement efforts that enrich both classrooms and schools, they need to give teachers opportunities to explore curriculum and instruction and to share their thinking with one another. For example, fourth-grade teachers might want to improve students' thinking (processes and products) during small-group instruction. A pair of teachers who work in a high- and a low-SES school might tape record a representative group of four or five students during small-group assignments, on repeated occasions. After studying the tapes and defining the problem, the teachers could read relevant literature, consult with other teachers in the district and researchers who have conducted studies in the area, and develop a plan for altering curriculum or instruction. The two teachers could observe one another's classes (watching students interact) and assess the effects of changes on students. The tape recordings would be available for reanalysis by other interested teachers and researchers who might define success in various ways. Thus, like all scholarly activity, the research would be conducted by people who are experts (certainly no one would know the classroom context and the needs of students any better than the teachers conducting the study and other teachers in the district who teach similar students) and would include peer and professional review.

There are many potential advantages of teacher research and scholarship. For example, they help teachers to think more deeply about problems and issues -- especially problems that teachers can help to solve. As noted earlier in the paper, much unsuccessful curriculum reform has been generated by persons who have little information about classroom and school factors that may hinder reform. Further, teachers seldom have the chance to discuss ideas with other teachers. Thus, by promoting the sharing of resources and ideas among teachers who teach in similar contexts (e.g., same grade, same topic) and different ones (e.g., students of varied achievement) research can illustrate to teachers how an instructional behavior, for example, might have different effects in various settings.

With any research, the critical factors are the skill of the researchers and the usefulness of the questions raised by the research. I suggest that teachers be allowed to explore any question that they deem relevant. However, some secondary guidelines for evaluating research proposals might be useful. Although it should be possible to fund significant projects submitted by individual teachers, teachers should be encouraged to submit proposals jointly, since teachers otherwise work primarily in isolation. Thus, perhaps a small preference should be given to joint proposals.

A second guideline would require some clear support of projects from the district (e.g., perhaps matching one-half the cost of the grant). If schools do not allow time for teachers to reflect on schooling and discuss it with peers, then the district should provide teachers with sufficient release time to do so.

Third, proposals involving research that affects both classrooms and schools should be favored. For example, there is considerable evidence of needless redundancy of content (see McKnight et al., 1987) so that a research project that would lead to comprehensive curriculum knowledge and to greater coordination of curriculum and instruction among grades in a school would be very useful. Another means of assuring participation of teachers at various grades in research would be to require teachers who are funded to report on their study to the entire school. All teachers in the school could debate the usefulness of knowledge from the research at various grades.

Teachers' Performance Expectations

Although much is known about how teachers form and communicate expectations for individual students, little is known about how teachers develop expectations for entire classes of students. It seems instructive to inquire into this process for all teachers, but especially for beginning teachers. Many teachers have not had much experience teaching or observing at a grade level until they have a formal contract and begin teaching. For example, a beginning teacher may observe in a first-grade classroom as a requirement of a university class, student teach in a third-grade class, and then begin teaching in a sixth-grade class. Thus, a teacher may be especially likely to adopt the norms held by other teachers at the same grade level in the school in which the teacher first teaches. Obviously, mentor teachers or more experienced teachers may also have limited knowledge of appropriate performance expectations for students at particular grade levels.

One wonders how teachers learn what constitutes appropriate subject-matter teaching (e.g., level of cognitive sophistication) at a particular grade. How can teachers determine what constitutes appropriate and accurate subject-matter teaching to a particular class of students? Could teachers of equal talent who start to teach in similar contexts (e.g., same grade level, same type of pupils) develop radically different conceptions of what is important and appropriate? If so, how do these conceptions influence classroom assignments and interactions with students? Do teachers' performance expectations for students influence students' beliefs about various subjects? How can beginning teachers gather and analyze useful data about appropriate performance standards for classes and for individual students? Do teachers discuss issues associated with content selection and pace, and how do they decide on appropriate standards?

Within this general theme, one could empirically study many questions. For example, do teachers who student teach at the same grade (or an adjoining one) at which they begin teaching develop more appropriate conceptualizations of teaching than other teachers? Do these teachers simply continue to do what was modeled for them in student teaching, with comparatively little reflection?

Obviously, countless questions could be raised about beginning teachers and how they learn to teach. However, considering the growing interest in the normative influence of colleagues on teachers and in subject-matter teaching, it is important to examine how teachers develop performance expectations for students in various subjects. Virtually

nothing is known about this topic, and research and development might increase teachers' expectations.

Creating New Student Outcome Measures

Teacher- and school-level research have resulted in a growing interest in addressing higher-order outcomes. In many districts teacher accountability measures determine the curriculum. This is unfortunate, because most accountability devices yield a narrow definition of curriculum. Some situations are particularly tragic. For example, despite massive funding of Title I and Chapter I programs, many low-achieving students continue to have difficulty in mastering basic skills. The focus on basic skills often initiates a chain of events that almost guarantees that many students will make little progress. Because assessment of remedial programs stresses mastery of basic skills, teachers who believe that low-achieving students need more practice and drill if they are to master basic concepts may overemphasize drill and practice. Students are exposed to the same concepts year after year and continue to memorize formulae and processes that are neither meaningfully presented nor studied in a motivating context. The curriculum is often so narrowly focused that many low achievers do not understand the general principles and concepts that are associated with the skills. Moreover, since most learning in some contexts involves rote memorization, any learning that occurs is quickly forgotten. When achievement tests indicate that students' performance on basic skills has not improved substantially, pressure for drill and practice increases.

There is good reason to believe that a balanced instructional program that focuses simultaneously on skills, concepts, and problem solving could

help students to become more active and successful problem solvers. Greeno (1989) suggests that a key question related to emphasizing critical thinking is whether individuals can think reflectively rather than simply carry out procedures or statements without any real understanding.

Since the brain codes and processes information, virtually any stimulus from the environment will produce some thought. Newmann (in press) notes that all cognitive processes, for example, watching a baseball game, reading a map, or listening to a teacher, are "complex" in a neurological sense. How, then, can one distinguish higher-order thinking from other forms of thinking? Newmann (pp. 4-5) makes the distinction in the following way: "Lower-order thinking demands only routine, mechanistic application of previously acquired knowledge; for example, repetitive exercises such as listing information previously memorized, inserting numbers into previously learned formulae, or applying the rules for footnote format in a research paper. In contrast, higher-order thinking challenges the student to interpret, analyze, or manipulate information, because a question to be answered or a problem to be solved cannot be resolved through the routine application of previously learned knowledge."

Obviously, this distinction is relative, because what constitutes a challenge, puzzle, or higher-order thinking for one student might only be a repetitive exercise for another student. Thus, research in the 1990s will need to explore how particular teacher examples or assignments encourage students to analyze and integrate the new information and assignments. In this sense, the study of teacher behavior becomes a fundamental challenge when researchers ask questions about how teaching

influences student thinking. For example, when they ask what makes a good lesson presentation, the answer may vary depending on what one wants students to do (e.g., to know how others have defined the problem, how others have attempted to solve the problem, or to attempt new and novel responses).

Newmann (in press) is developing observational scales in an attempt to identify social studies classrooms that are "mindful" (encourage higher-order thought) versus those with a routine, mechanistic focus. As the history of research on teaching indicates, effective teacher behaviors are varied, and what works in one classroom context may not necessarily work in another. The empirical investigation of "mindful" social interaction and thought is intriguing and, I believe, important. However, I want to stress that this work will not yield a list of the key characteristics of classrooms that encourage higher-order thought but rather will offer concepts and terms that allow meaningful distinctions among teachers and classrooms. What 30 or 40 characteristics describe a "mindful" social studies classroom and how might that classroom differ from a "mindful" science classroom? Do Chapter I classrooms have unique constraints on mindfulness? What are some of the important ways in which context variables (age of students and type of school setting) interact? By anticipating both general findings and context effects, researchers are more likely to discover relevant characteristics than if they assume that the outcomes will be general (or highly situational). If progress is to be made in this area, several studies that examine different contexts should be funded.

Because teachers are vulnerable to external pressures, including an emphasis on test scores, they are unlikely to include higher-level objectives in classes populated by low-achieving students unless accountability devices are changed substantially; particularly in the early grades, where the greatest percentage of test items now cover "drillable" content. Moreover, defining the curriculum in terms of a test imposes problems for all students. For example, many talented students study content that they have mastered in earlier grades.

Attention to students' ability to use information, to collect data, to pose interesting questions, to use subject matter to answer their own questions is needed in addition to the study of basic skills. It is now time for educators to emphasize these outcomes of schooling that have been neglected. Although important advances have occurred in educators' thinking about successful instruction, most achievement tests do not measure students' progress on the basis of this modern, comprehensive view of learning. Thus, we cannot assess whether instruction that combines adequate subject-matter knowledge, pedagogical content knowledge, and the ability to construct classroom environments that call for both active student learning and active teaching improves students' higher-order thinking skills. Unless we develop better outcome measures, we will be forced to accept claims about the influence of curriculum approaches on students' higher-order thinking skills with no compelling evidence, or we will simply have to ignore the issue. It seems to me that neither of the latter positions is acceptable.

I do not advocate state-mandated (or federal) testing programs, and I believe that money spent on these programs wastes valuable resources that

could be spent on other activities. For example, some states test all students at a particular grade level, when other designs would yield equally valuable information and save a vast amount of money that could be reallocated to activities that would be of more use in improving teaching-learning. My comments here in terms of the need to develop new assessment devices are not an argument for improving state-mandated testing programs. New instruments that are carefully conceptualized and validated would help many schools to more successfully reflect on and plan for improving their curricula. Further, to address sophisticated questions about the effects of multiple variables on student learning, researchers will also need better instruments. However, if states rather than individual schools and local communities insist on using state-mandated testing programs, then it seems imperative for those states to develop assessment procedures that examine student performance in more sophisticated and diverse ways.

Curriculum

With the increasing interest in subject-matter variables in classrooms, it is important to encourage research that identifies key concepts in various subjects and to begin programs of development. Much has been written about the need for mathematics teachers to focus more on problem solving, but relatively little conceptualization has been given to the nature of the problems students are to explore. In what ways do good problems at the third- and sixth-grade level differ? What concepts should be taught in fourth-, fifth-, and sixth-grade science and mathematics? As teacher-researchers and researchers identify those concepts, the study of many related issues could be structured. What strategies are best for teaching particular concepts? How can research identify, extend, and

validate extant pedagogical content knowledge? How can researchers identify the knowledge teachers possess and how can they use information coming from cognitive science and other research in order to enhance teachers' knowledge of subject-matter teaching?

What beliefs do teachers hold about teaching generally, and math and science specifically, at grades four, five, and six and how do these beliefs influence teaching of particular subject-matter concepts? Is it possible to document relationships between clusters of teacher behaviors (including teachers' subject-matter knowledge, pedagogical content knowledge, knowledge of how students learn particular content, and general knowledge of teaching), and how teachers help students learn certain concepts, as well as the effects of such strategies on students' learning and performance?

Some important work has been started in this area, and it is clear that satisfactory performance does not necessarily guarantee that students' understanding of concepts is adequate. Ball and McDiarmid (in press) note that in various subjects there is growing evidence that students can produce satisfactory work without understanding the subject matter. Similarly, Schoenfeld (1985) describes the inability of his undergraduate mathematics students (most of whom had done well in an earlier college calculus course) to explain some fairly simple geometric problems. Although the students, working as a group, could solve the problems, they struggled to explain why a particular solution had worked.

A recent examination of the problem of mathematics instruction in the United States is summarized in the 114-page report, Everybody Counts: A Report to the Nation on the Future of Mathematics Education. This

document contends that, "today's schools labor under the legacy of a structure designed for the industrial age misapplied to educate children for the information age." If this strong message is correct, then the basic mathematics curriculum needs drastic changes. However, we have little evidence on or conceptualization of what the curriculum for the information age should look like and how that curriculum might vary across contexts (e.g., an inner-city elementary school; a suburban high school; a rural middle school). It is time to begin this important work. Although there are many ways to approach the curriculum issue, one interesting framework is the notion of students' misconceptions that prevent students from understanding new information or new instructional activities (potentially valuable new data or instruction is misperceived because of inadequate or faulty cognitive structures). Thus, educators must determine what common misconceptions students hold. How can we identify, extend, and validate knowledge of instructional strategies that help students to develop more accurate and useful conceptions? Does successful teaching in grade four (i.e., appropriate use of pedagogical content knowledge and subject-matter knowledge) allow grade five teachers to spend less time correcting misconceptions and more time presenting new concepts or exploring new applications of concepts that students have previously learned? If the knowledge of teaching subject matter in particular settings (e.g., science and mathematics concepts in fourth, fifth, and sixth grades) becomes more advanced, how might the considerable time previously used in grade six to reteach, review, and correct students' misconceptions be reallocated so that sixth-grade students could explore science and mathematics in novel ways?

Student Mediation

It is important to explore the conditions under which students are encouraged to think. Recent research and conceptualization (e.g., Wittrock, 1986) have focused on how students process information from teachers, textbooks, or classroom activities. However, there is virtually no information about which assignments and teacher behaviors are more likely to engage student thinking. What constitutes a good seatwork activity or good end-of-the-chapter questions? Does the quality of good seatwork tasks vary with student ability and their perceptions of the task or are there some general characteristics that can be articulated?

It is popular to assume that when students "do" they are more likely to think, although there is little evidence on this topic. Activity in classrooms is in many respects similar to activities elsewhere. For example, one would not argue that U.S. automobile factory workers on an assembly line engage in much job-related systematic thinking. Similarly, activities that involve students in applied work may not stimulate their thinking, particularly if students engage in them frequently. For example, many students will "tune out" if they frequently work in groups. When teachers lecture for long periods, many students' attention may begin to wander, although certain types of teacher talk may stimulate active thinking. Research needs to describe various types of classroom presentations and activities and whether these stimulate student thinking and covert reaction.

Covert thinking. Several theories could serve as a basis for this research. For example, Rohrkemper (in press) argues that inner speech guides thought and action as students attempt to deal with learning

situations. She notes that two distinct types of inner speech have been identified and represent the potential integration of the affective and the intellectual. Self-involved inner speech reflects control over the self through enhancing motivational and affective statements, whereas task-involved inner speech involves control over a task through problem solving and attempts to modify the task to make it more understandable or more "doable." Thus, in combination, self-involved and task-involved inner speech may allow students to function in adaptive ways either by enabling them to change a task or to modify their self-perceptions and/or effort.

Students bring complex histories to school learning tasks. They differ not only in the ways in which they have achieved mastery over particular concepts or the cognitive skills they possess but also in whether they can use self-involved inner speech in relevant and adaptive ways. Some students have learned to use their resources to deal with difficulty. Others have learned to give up or to turn to others for help when they have trouble learning. How students at various levels benefit from interaction with the teacher or with peers is far from clear and is an important topic for research. What happens when particular students are grouped? If one student in a group cannot use self-involved and task-involved inner speech with facility, is this an advantage or a disadvantage? Although it is currently popular to argue that grouping promotes active learning, we do not know how tasks and group membership affect the information processing of individual learners. Such research should be funded so that student thinking in classrooms can be examined.

Problem-solving style. Recent cognitive science research has produced some fascinating findings about individual learners in laboratory settings and research on student learning continues to yield interesting findings. However, as exciting as these findings are, their application to classroom learning is problematic. In one such study, Duemler and Mayer (1988) examined students' reflection in non-classroom problem-solving situations. They explored the prediction of rationality theory (e.g., Baron, 1985) that more reflective individuals perform better on problem-solving tasks than more impulsive individuals. In assessing students' scientific reasoning, they noted that some students were likely to verbalize their hypotheses much more rapidly than other students, who waited for more evidence. These investigators wanted to explore the influence of this behavior -- willingness to express hypotheses -- on problem-solving success.

In two experiments using college students and employing different dependent measures, Duemler and Mayer obtained consistent results -- a U-shaped relationship between the subjects' tendencies to state incorrect hypotheses on conventional rule-induction problems and subsequent success in solving an unconventional problem. That is, students who never stated incorrect hypotheses on conventional problems performed relatively poorly on solving an unconventional problem. The researchers reasoned that these students' poor performance might have occurred because their search for problem solutions focused on conventional hypotheses. In contrast, subjects who sometimes stated incorrect hypotheses for conventional problems tended to perform well on an unconventional problem. According to Duemler and Mayer, this is probably because these students' hypothesis-

generation styles allowed them to develop unconventional hypotheses and to systematically evaluate these hypotheses.

Do these results apply to a teacher who works with the class as a whole? Do they suggest that the teacher should develop students' capacity to verbalize reasonable hypotheses, or that studerts should have more domain-specific information that might reduce memory load and hence make it easier for them to generate relevant hypotheses? What implications does Duemler and Mayer's work have for teachers who assign students to four- or five-person teams? Does it suggest that there should be a mix of impulsive and reflexive learners? Does the appropriate match or mismatch of students on the basis of reflexive style vary as a function of tasks, age of students, subject matter, or friendship patterns? I want to emphasize that I find the Duemler and Mayer study valuable; however, such studies must be conducted in classrooms, where numerous variables affect student performance.

It is clear that students think and that their thinking mediates teacher behavior and class assignments (the same assignment will mean different things to different students). However, research needs to explore what teacher statements and classroom activities stimulate higher-order thinking, especially on the part of students who have been passive learners for several years. It seems especially important to integrate theories of learning and development -- for example, the role of social language in facilitating learning (Rohrkemper, in press) with theories of classroom contexts. We need comprehensive naturalistic and experimental studies of how student developmental variables interact with student learning styles (e.g., learned passivity) in various learning situations

(e.g., rural classrooms). These studies can examine both instructional and curriculum variables.

Classroom organization. Another factor that affects student thinking is classroom organization. I believe that small-group instruction can enhance students' higher-order cognitive skills. When I point out the limitations of small-group instruction, I do so only because I want to see the format used appropriately. There is a tendency to equate small groups with increased student activity and thinking. However, some sophisticated research illustrates that small-group instruction, like whole-class instruction, has various effects and that the quality of instruction is most important.

Peterson and Janicki (1979) studied fourth- fifth-, and sixth-grade students' academic and affective responses to small-group and whole-class learning situations. Their data showed that low-ability students achieved better in whole-class settings. Janicki and Peterson (1981) found that both high- and low-ability students had more positive attitudes toward mathematics in the whole-class context than in the small-group context. Students who initially had more positive attitudes toward math and who had a high internal locus of control did worse in learning situations in which direct instruction was utilized.

Cooperative curriculum tasks. In addition to classroom organization, the curriculum tasks that students are assigned also affect students' thought processes. Good, Reys, Grouws, and Mulryan (1988) report that students who have been asked to work cooperatively in small, heterogeneous work groups often work independently in part because they have done so in previous years. Thus, tasks must be carefully designed to encourage

cooperative behaviors. Even when efforts are made to insure that a task is significant and calls for cooperation, some high-ability students still prefer to work alone.

Other students may become relatively passive in groups. Indeed, there is clear evidence that many students have learned to withdraw from classroom learning situations and seldom initiate contact with teachers about academic issues (e.g., Good et al., 1987). How, then, do teachers deal with students who have learned not to verbalize their tentative thoughts and that sharing information often leads to the perception that they are inferior to other students? Research that examines how students interact in small cooperative groups, that compares student thinking and student success across various dimensions and types of tasks, would help us better understand when and how grouping can stimulate productive student thinking.

Generality of cognitive task. Another important variable in student mediation research is the level at which students' cognition is addressed. Although some cognitive science theorists argue that adaptive thinking is very situation-specific (e.g., Greeno, 1989), other theorists are more optimistic about the potential of schools to enhance students' cognitive ability. For example, Perkins and Salomon (1989) note that a belief in the generality of cognitive skills is to some extent on the rebound. At one time, psychologists argued strongly for the generality of cognitive skills. Then the field went through a period in which it was popular to argue that cognitive skills are highly context-specific. According to Perkins and Salomon, early advocates of the importance of general cognitive skills paid too little attention to the need for a rich

knowledge base and spent little time theoretically articulating how skill transfer was to occur. Because of these mistakes, many critics expressed considerable skepticism about the value of general cognitive skills. However, these overreactions have caused problems as well -- most notably the failure to recognize how general heuristics help when experts face atypical problems in a domain, how general heuristics can help an individual to use domain-specific knowledge, and how lack of conditions needed for transfer (rather than domain specificity) may be to blame for many cases of failure of transfer.

Perkins and Salomon make the interesting and useful distinction between educating memories and educating minds. They argue, "to be sure, general heuristics that fail to make contact with the rich domain-specific knowledge base are weak. But when a domain-specific knowledge base operates without general heuristics, it is brittle -- it serves mostly in handling formulaic problems. Although we don't want the weak results of the kind of attention to general heuristics that neglects knowledge base, we also don't want the brittle competency forged by extensive attention to particularized knowledge! We would hope for more from education. And according to the synthesis theory, we can get more" (page 23).

These authors point out that most efforts to develop general cognitive skills have not focused on bringing together context-specific knowledge and general strategic knowledge. They argue that education now needs this integration, that it needs to go beyond educating memories to educating minds, which is the central issue of education.

According to Perkins and Salomon (1987, 1988), there are now guidelines available for classroom practices that can foster the transfer

of knowledge and skills. Studies suggest that certain general skills that seem to have a reasonable degree of generality can be taught directly (e.g., Palincsar & Brown, 1984). It would seem that research studying how student mediation variables operate in specific curriculum areas would be of considerable importance. What are general cognitive skills we would want students to have for dealing with "data" (or whatever) in fifth-grade science and math classes and how do explicit forms of student thinking influence the level of generality at which the concepts of "data" can be learned in a classroom setting.

Again, I want to call attention to how fragile the knowledge base in student mediation is. Although a few studies have examined student behavior during small-group instruction, few have examined both student behavior and student thinking. Fewer studies yet have looked at how task demands influence students' conceptualization (Is cooperation among students required? Is detailed domain-specific information required?). At this point, needed are comprehensive strategies that explore how organization (large group, small group) tasks and student mediation operate simultaneously.

Arguments about the importance of student mediation during instruction is becoming increasingly complex and several models have been developed for helping to explain why students sometimes have difficulty in understanding key concepts ... concepts that often teachers spend a lot of time on in instructing students (e.g., Perkins & Simmons, 1989). The richness of cognitive science basic research, however, needs to be brought into the classroom and we need to begin to explore how students react to specific lessons under known instructional conditions.

We need to make major investments exploring various students in various contexts (e.g., first graders learning to read, college students exploring introductory physics concepts). We need to recognize that much basic research needs to be funded exploring student mediation and thinking in actual classroom situations. Laboratory research has been important and should be continued; however, we need to recognize that students learn in complex social environments and we need to explore cognition in those settings. Further, the attempt must not be to teach students simply skills but rather to assist students to reflect and think in complex environments.

The argument here is not necessarily for applied work simply because the focus is on classroom learning. Rather, I believe that OERI should invest heavily in basic research studies that attempt to determine how students think during various classroom events. Do students attend more to teacher presentations than peer presentations and is this true across different types of tasks? How long do students attend to any informational source (whether reading silently or talking to a lab partner)? We need a generation of research on cognition in classroom settings. Thomas (1980, 1984) argues convincingly that the miracle drugs of the 20th century were the direct antecedents of 100 years of prior pure and often seemingly irrelevant science. Thus, again, I argue that research is needed that explores basic cognitive processing of students during classroom instruction with no necessary intent upon improving instruction in the short run. We need to understand how students process and perceive information under various classroom conditions. However, as argued earlier, we do need to more critically conceptualize the issue of

student thinking within specified boundaries -- in response to specific curriculum issues and teacher variables.

School Structure

Considering the concern with making teaching more professional by altering the workplace conditions of schooling, funding agencies and school districts should invest in experiments at the school level in which the structural conditions of teaching are altered. Schools selected for participation in such research must demonstrate that their teachers and administrators have already developed norms for professional collaboration among teachers (e.g., exchange information, gather relevant data and other information, put new insight into practice). By studying such schools, researchers could determine what teachers who work as professionals can accomplish. For example, it might be useful to examine what would happen if teachers reallocated 20% of the time they spend instructing students to other activities. In such restructuring experiments, it would be important to determine how teachers reallocate time (read more, phone more parents, talk with peers, conduct action research, observe other teachers, build curriculum units) and how changes in time utilization affect students' performance and motivation. Could schools be redesigned so that students spent more of their time in constructive group work and individual activities? Students in such schools might have the opportunity for more labwork and independent study. Curriculum units in these schools might be better integrated, emphasizing concepts rather than isolated facts. Reciprocally, one could argue that new structures and related opportunities might not be used to motivate and to extend student thinking but rather to supervise and to control students

since the learning activities would be less teacher-directed, at least for some portions of the day. To reiterate, because the process of restructuring is of critical importance, it is important to verify that teachers in schools participating in the funded experiments have already exhibited the capacity for professional behavior. The issue to be examined would not be what happens when schools are given more funds but rather what happens when schools that allow teachers to function in professional ways are given adequate resources to expand teachers' role as professionals.

Power (1989), drawing upon a recently complete study by the RAND Corporation notes that the RAND Corporation had been successful in identifying a list of contract statements that helped to distinguish reform-minded faculties that were supporting teacher professionalism. In the study, roughly 20 differently contract provisions promoting teacher professionalism were identified. Included among the list were some of the following: 1) duration of school day is specified, 2) teachers are guaranteed preparation periods, 3) maximum class sizes are specified, 4) teachers paperwork load is limited, 5) number of classroom interruptions are limited, 6) salaries are paid during sabbatical leave, 7) teachers evaluated as unsatisfactory get help, 8) the number of subjects, grades, or ability groups a teacher must teach is limited. Needed are clear theory and good empirical data to illustrate how contracts and other structural variations influence school learning.

Hallinger (1989) points out that some -- perhaps many -- high school principals would not be able to serve as instructional leaders. He argues that it may be possible for high school principals to become effective

instructional leaders by developing teachers' leadership capacity. However, in my opinion, to be an instructional leader a principal must also have a good general knowledge of research on effective teachers and schools. Although a principal cannot achieve specialized knowledge in all areas, he/she should understand some of the issues involved in designing and evaluating teaching-learning in complex subjects. Still, the issue of school leadership teams and local decision making opens up exciting possibilities for different types of structural change and the opportunity to examine how variations in structure affect teacher and student conceptions of subject matter and students' ability to use subject-matter knowledge in responding to problems that involve critical thinking.

As Colvin (1989) notes, schools are beginning to experiment with new lines of authority and in some cases allowing principals and teachers to make choices about allocating resources. To do this, however, schools must be able to estimate how much a given teacher's time is worth and how that time should be allocated. What schools need are conceptual and empirical analyses that examine alternative ways to use school personnel. Do we hire master teachers or more teachers?

There is a paucity of information to describe how large school districts function and especially missing is information about effective functioning. Hill, Wise, and Shapiro (1989) argue that an urban school district can improve only if the entire community is working toward the improvement of the school district. In their study of six school districts (Atlanta, Cincinnati, Memphis, Miami, Pittsburgh, and San Diego) report that four general conditions were necessary for improving schools. They noted that these school districts improved in part because they were

able to encourage the larger community to become involved in educational issues and also because they made information about school needs and resources ... and student performance broadly available. Further, they created community-wide agreement about the need to achieve certain educational goals and further, they were able to successfully subordinate the traditional role of school boards, teachers, and administrators to the broad mandate of a system-wide improvement effort.

Needed also are better understandings of why some school districts are better able to respond to the needs of initiatives of individual schools than are other school districts. Along these lines, it would be instructive to see how central office staffs make decisions about staff development across the district and how these programs actually relate to the interests that teachers in individual schools have. We spend large amounts of dollars a year on staff development; however, the evidence for either global or differential effectiveness is uncertain (Stringfield, personal communication). It seems important to begin to examine how the various funds that are utilized by districts on workshops, new equipment, curriculum supplements, and so forth actually influence students' opportunities in the classroom. Are there more effective ways that school resources could be spent?

Research Funding and the Roles of Regional Laboratories

The major task that I was asked to undertake in writing this paper was to comment upon important ways to expand the extant knowledge base about teaching and schooling. However, I was also asked to share a few thoughts about the present and continuing funding of educational research and the roles of regional laboratories.

Research and development centers can be a substantial force for helping educators to become more knowledgeable about productive learning in school settings. Regional laboratories can play a significant role by helping school districts to understand research and to use it appropriately. Laboratories can also assist school districts in conducting action research. However, I believe that we also need to stimulate diverse lines of inquiry by making more funds available to individuals to conduct research.

Funding

I believe in a balanced approach to research and development that stresses research and development centers, regional laboratories, and individually-initiated field research. In my judgment, all three of these areas are woefully underfunded by OERI. Individually-initiated field research is particularly underfunded, probably because individual researchers and single institutions simply do not have the political constituency and political power needed to argue successfully for money when funds are scarce.

Considering the complexity of successful teaching/learning in complex social situations, it is vital to broaden the base of research scholars to the fullest extent possible. Investments in 100 different investigators might eventually lead to the development of 10 substantial lines of inquiry that could then be systematically pursued in organized research and development centers. Ultimately, the products of this knowledge could be effectively disseminated by regional laboratory personnel. The existence of a large number of investigators challenges the status quo in appropriate ways and generates more comprehensive studies than is possible

than when funding is limited to a small number of institutions with a fixed agenda.

Because the extant knowledge base about schooling is so limited, I encourage the expenditure of new funds in order to maximize the potential for gaining new knowledge. As I have indicated, I think the budget of OERI should be increased by at least 600%. I would argue that 50% of new funds ought to be designated for field-initiated research in order to build an infrastructure for research and development. The larger the number of researchers, and the broader their backgrounds, the healthier the field will be in the long run. I want to stress that my suggestions do not challenge the funds currently allocated to labs and centers; I am talking about new funds that come into the budget. Of the remaining 50% of the new funds, 35% or so should go into research and development centers, and roughly 15% of new funds above current levels into regional laboratories. After a decade of successful funding for research activity, one might want to reverse these figures so that proportionally more money is spent on dissemination. It currently seems most important to stimulate new research activities. If regional laboratories are to be restricted to a dissemination role (I'm not sure that this restrictive role is most appropriate; however, it is the role that is presently assigned), proportionally fewer of the new dollars should be spent on dissemination. The logic of this position is simple: we need to produce more knowledge that can be disseminated.

Laboratories' Roles

Disseminating results. It seems to me that regional laboratories can continue to play several important roles. First, they can disseminate

findings and concepts. Although research appears to have levelled off to some extent, many useful concepts have been generated in the last 20 years. Since some of this research knowledge is relatively old, (e.g. Kounin's groundbreaking work on classroom management in 1970), it is easy to assume that it has been disseminated. However, as I work with teachers in various communities, I find that many teachers still do not have a working vocabulary for discussing important variables such as management, expectations, or instructional systems. Efforts to help teachers understand key concepts for analyzing their teaching and that of peers are critical. Regional laboratories ought to establish whether most teachers are cognizant of findings and concepts from effective school and classroom research (e.g., wait time, with-it-ness, alerting, passivity model, active teaching, etc).

I think it important that knowledge not be disseminated passively. That is, I am not calling for laboratory personnel to produce documents that describe the knowledge base. Many excellent sources of this knowledge are available -- for example, the book that Jere Brophy and I have written, Looking in Classrooms, provides a useful summary of research concepts and knowledge in various areas, including student mediation, direct teaching, mastery learning, and cooperative learning. Regional laboratories could combine books such as ours (or other published sources) with new formats and learning materials that help teachers to become more effective consumers of research.

There are currently too many overlapping, redundant articles and reports. We now need seminars that combine more active illustrations of knowledge, such as videotapes of classroom teaching (or videotapes of

students learning cooperatively in learning groups, etc.), and written materials that teachers could study in advance. This would enable teachers to use concepts as they analyze teaching and make suggestions about improving their own teaching and that of peers. The emphasis would be on helping teachers develop a working knowledge of existing technical concepts that they could use to analyze teaching. At the same time, teachers would learn that research does not yield prescriptions -- it only provides analytical concepts and findings that teachers can use to think about teaching in a particular context. Teachers would be encouraged to consider the quality of teaching and intended outcomes. Unfortunately, too many evaluation systems focus narrowly on the format of teaching and ignore quality (i.e., the reasonableness of the examples that are chosen and the appropriateness of the subject matter). This occurs, I believe, because basic research findings have been inadequately disseminated. Regional laboratory projects that involve teachers in the critical analysis of teaching merit funding.

Publicizing new findings. Regional laboratories also should expose teachers to some of the new findings from subject matter research and student mediation research. This research is still in its infancy, and there is little detailed information about how teachers' conceptualizations of subject matter influence students' views of subject matter or the ways in which they will ultimately use it. Still, teachers should be introduced to this literature (e.g., Carpenter et al., 1988; Shulman, 1986; Smith & Neale, 1989) and discuss issues such as teachers' knowledge of content, teachers' pedagogical content knowledge, and appropriate strategies for teaching content and/or identifying key

subject-matter concepts and student misconceptions. Such discussions could sensitize teachers to a broader range of constructs that they could use as they think about and plan instruction.

Helping principals become instructional leaders. Regional laboratories could also prepare principals to play instructional leadership roles. It appears that many principals inappropriately use knowledge about teaching (e.g., Brophy, 1988; Good & Mulryan, in press) and that much could be done to help principals to become more effective instructional leaders. In too many cases principals still remain relatively uninformed of recent advances in motivation, instructional delivery, student mediation, and classroom management (e.g., see Good & Brophy, 1987). Principals could use this information to help teachers become aware of alternative instructional practices and plan classroom activities that allow more active and successful student learning. Some principals have interpreted research on teaching too literally and have used it to make rules for how teachers ought to behave in the classroom. Here the misplaced emphasis is upon the form rather than the quality of instruction.

Developing educators' research skills. Because research must be interpreted and applied in a given context, principals and teachers should learn to conduct their own research. Teachers and principals need to gain knowledge about research skills that would be of most use in their particular settings. Unfortunately, few teachers possess the detailed knowledge and technical skills necessary for conducting research. They would likely benefit from seminars and programs that help them develop skills for collecting observational data, understanding single-subject

research designs, and help them become more systematic in their efforts to understand their students' performance.

Too often training programs emphasize quantity -- the number of teachers who are exposed to ideas in a given period of time. However, any program attempting to develop teachers' research skills should focus on the development of skills in a few select teachers over a long period of time. That is, a highly successful program might involve 25 to 30 teachers who are released for a period of 10 days per year over a 3-year period. Teachers would develop important research skills, use those skills to conduct research, and then disseminate their research results to other practitioners. This procedure would establish a group of teachers who could help other teachers develop research dispositions and opportunities. Few teachers may become active researchers; however, it seems important to enhance research skills of interested teachers. Teachers have rich classroom expertise that is often ignored in the research. Efforts to make teachers more knowledgeable and skillful in conducting research would pay off in the long run by combining research expertise and clinical experience.

Breaking down teacher isolation. Regional laboratories could allow teachers to share ideas and resources around an organized agenda through the formation of teacher study groups, curriculum groups, or observational groups. Since few teachers have the opportunity to interact on a professional basis with other teachers, state-wide or local study groups that take on significant educational problems could be an extremely meaningful activity. The format and nature of these groups could take many forms; however, they should consist of teachers who have similar

interests and allow teachers access to relevant literature and resources, and time to read, to think, and to integrate the extant knowledge base with their experience. Teachers could develop specific strategies and more integrative curricula.

Analyzing curriculum. There is growing recognition that the school curriculum involves too much memorization of facts and learning of discrete topics. There is growing interest in helping students to develop more formalized and integrated knowledge of key concepts rather than covering numerous concepts superficially. The opportunity for teachers, administrators, citizens, professors of education, and professors of arts and science to participate on task forces is an important potential investment. In my opinion, the attempt to study curriculum on a broad scale often results in a frustrating inability to change anything simply because too much is attempted at once. However, if strategic areas were selected (e.g., science in first-, second-, and third-grade classrooms) and if creative individuals studied a curriculum area for an extended time, better analyses of the curriculum problem and better solutions could emerge. Although curriculum decisions necessarily should be made by local districts, investments by regional laboratories -- in organizing debates and analytical summaries -- throughout a region or state so that districts have more information and conceptualization to draw upon, could be a creative and important part of innovation in American education. Obviously, summaries and syntheses that are developed would have to be subjected to research and development activities; however, since these proposals are derived from local districts, at least some of the field-initiated research might be able to respond to these emerging

opportunities. That is, as new curriculum reforms and new structures in schools emerge, they should be validated through careful research.

Examining use of research in schools. Although I believe that laboratories can and should build model dissemination efforts and develop research skills of school district personnel, the sheer number of school districts almost guarantees that much laboratory work will necessarily involve leadership development for state government officials and central-office district personnel. Still, dissemination must be a primary activity for laboratories. The development of viable dissemination strategies requires firsthand knowledge of how principals and teachers interpret and utilize information from research. Further, if much of the activity focuses on helping district officials to develop leadership skills, then it will also be necessary to evaluate the extent to which research helps teachers to provide more thoughtful and creative instruction. Too much dissemination has been done without considering the effects of information on classroom behavior, for example, on students' thinking and problem solving. Dissemination cannot consist of relatively passive distribution of information but must help teachers creatively conceptualize and extent the curriculum and instruction that they consider.

Increasing communication between labs and centers. Although I am sure that there is informal contact between various laboratories and research and development centers, I know of no formal mechanism by which they discuss common problems (e.g., special dissemination issues associated with a particular research topic -- or, reciprocally, pressing concerns about which practitioners need information?). Considering that

centers and laboratories share overlapping concerns -- producing and sharing research knowledge with educators -- more public informal communication between these institutions might have productive effects on schooling. We need more systematic information about dissemination and conceptualizations of dissemination strategies that present knowledge in ways that enhance rather than constrain individual teachers' performance. Shared work by centers and laboratories might move this important agenda forward.

Intelligent Use of Research: A Final Note

Finally, it must be kept in mind that the role of research is not to provide simple solutions for educators, although one important task of research is to evaluate the effectiveness of various models for improving student thinking and motivation. Clearly, some instructional models will work for particular learners under certain conditions and others will not. The more teachers know about models and the limits of particular models, the more flexibility they will have for meeting the needs of individual learners. The task of research is to broaden -- not to narrow -- teachers' conceptions of practice. Hence, the value of research cannot depend on its ability to control practice but rather is related to the ability of research to help teachers comprehend classroom instructional problems and to respond to problems they confront. In this sense, research yields theory for "framing" problems and planning possible action, for broadening the range of student outcomes possible, for building technical skills and vocabulary necessary for discussing schooling with other teachers and educators, as well as providing practical information about the effects of particular instructional

learning strategies under well-specified conditions. The "needed research" described in this document is advanced in the spirit of broadening possibilities of practice in order to make teaching more reflective. Even research conducted by participants in a given school district will apply unevenly to other participants in a school district. It must be understood that research yields information and concepts that have applied in view of particular values and specific classroom contexts.

Our conceptions of what research is -- and could be -- have been too narrow and driven by immediate considerations. To improve the usefulness of research, a substantial increase in state and local funding is needed. Further, researchers must turn to long-term agendas, focus on both basic and applied knowledge, and broaden their understandings of what research can yield for practitioners who work in demanding and complex social settings. As researchers attempt to more carefully study classrooms, they must solicit the assistance of teachers and principals in conceptualizing educational problems and developing models to respond to those problems.

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