

# Working Paper Series

Appalachian Collaborative Center for Learning, Assessment and Instruction in Mathematics  
Working Paper No. 25

## **Research on Teacher Learning Communities: Implications for Professional Development for Mathematics Teachers in Rural Schools**

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June 2005

ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The project aims to (1) understand the rural context as it pertains to learning and teaching mathematics; (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people; and (3) improve the professional development of mathematics teachers and leaders in and for rural communities..



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Funded by the National Science Foundation as a Center for Learning and Teaching, ACCLAIM is a partnership of the University of Tennessee (Knoxville, TN), University of Kentucky (Lexington, KY), West Virginia University (Morgantown, WV), Marshall University (Huntington, WV), University of Louisville (Louisville, KY), and Ohio University (Athens, OH).



This material is based upon the work supported by the National Science Foundation Under Grant No. 0119679. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.



## Foreword

This manuscript was originally commissioned to inform the continuing evolution of the Center's Professional Development Teams. Recent funding changes and the attendant revisions in the Center's strategy for managing resources, however, have undercut prospects for the intended use: the practical situation that occasioned the paper no longer exists. The Center has therefore taken the decision to issue the manuscript as a Working Paper. The decision is appropriate because *Research on Teacher Learning Communities: Implications for Professional Development for Mathematics Teachers in Rural Schools* is an excellent formal scholarly review. It can stand alone with little reference to the specifics of the Center's activities.

Quite coincidentally, during the course of the production of this manuscript, Aimee Howley and I were invited to write a policy brief on the topic of professional development for rural teachers (Howley & Howley, 2004). The three-part message from Dr. Pendarvis and from the Drs. Howley is very similar: (1) Professional development that does not respond to rural context cannot be judged high quality; (2) little such professional development exists influential entities do not acknowledge the need; and (3) rural schools need purchasing power to influence the professional development market. The "context" to be engaged mostly concerns rural meaningfulness rather than the usual thoughtless presumption of rural deficits. Key rural meanings (Howley & Howley, 2004, p. 5) include "(1) attachment to place; (2) strong commitment to community well-being; (3) connection to outdoor pursuits and the natural environment; and (4) concern for the long-term endurance and stability of life-in-place."

Craig Howley  
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June 12, 2004

### Executive Summary

Professional development for teachers of mathematics is changing dramatically. It is changing, in terms of content and pedagogy—because of the National Council of Teachers of Mathematics standards, which imply a more collaborative, constructive, and student-centered approach to instruction—and in terms of format—because of research on the importance of situated learning for changing teachers’ practice in the classroom. Workshops and university courses are being replaced by on-site, field-based training, either in person or through distance learning technology, and by teacher learning communities.

These changes are particularly important for rural schools because of their difficulty in recruiting and retaining qualified teachers due to low salaries, geographic isolation, and lack of access to amenities such as clubs, theaters, shops, sports facilities, and even, in some cases, medical care and hospitals. New situated-learning, professional preparation and development communities hope to address two timely issues: the immediate concerns related to personnel qualification requirements of the No Child Left Behind legislation, and also to long-standing problems of recruitment and retention.

### Major Design Elements

Research on teacher learning communities, sometimes conceived as communities of practice, indicates that they represent a promising new approach to professional development. Evaluative studies have found that such communities can help teachers improve and enhance their content knowledge, pedagogical skills, and professionalism, and encourage teachers to be more receptive to reading research and theory and to designing and conducting their own research projects. Though the literature on these communities seldom addresses mathematics

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teacher learning communities or rural teacher learning communities specifically, the available research is applicable to these types of communities. It suggests that designers of all teacher learning communities should ensure, as far as possible, that their design helps to foster and include: :

- Means of developing or identifying tasks that the community regards as meaningful work;
- Facilitative, task-oriented leadership that validates the community's work;
- Trust and feelings of belonging among community members;
- Opportunities for community members to reflect on relevant issues and practices;
- Opportunities for members to collaborate in instructional practice and improvement of practice;
- Activities that focus on integration of content and pedagogy.

The research literature also calls to designers' attention the importance of taking individual biographies into account in organizing learning communities and their activities. Disparate values and purposes among individuals in the community can undermine the cohesiveness of the group and can, especially in cases involving negative attitudes toward minority groups, have negative impacts on professional development. Racial and ethnic stereotypes and inequities of class and gender pose serious threats to the success of diverse communities and to the personal and professional well being of members of minority groups. Designers should be aware of the many different biographical factors that can influence the group and try to ensure that there is a balance of political power within the group that favors the productivity of the community and the welfare of all of its members. Otherwise, it is unlikely that long-term benefits to the teachers and to the culture of the school will be attainable.

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### Barriers to Overcome

The literature on teacher learning communities identifies some major systemic barriers to the establishment and maintenance of effective professional development programs. These barriers include the lack of funds for professional development, the hierarchical nature of leadership in the schools, and a lack of administrative commitment to teacher learning communities, arising from problems of funding and hierarchy.

Some researchers caution those who would design them that teacher learning communities cannot accomplish much unless they cultivate among teachers critical reflection on their own teaching practices. As one waggish author has noted in a book title, it is not necessarily true that practice makes perfect—in many cases, “practice makes practice.” Nonproductive practices can be promulgated at least as readily as productive practices. Student-teachers are dismayed that what they learned in their university campuses doesn’t work in the real world of the classroom. They are facing the reality that the classroom is a complex of forces, some working toward the achievement of all students and some working against students’ achievement. The classroom reflects the contradictions of national, local, school, and teacher-student politics. Practice, understandably, includes short-cuts that make teaching over-sized, under-equipped classrooms bearable, but such short-cuts often work against optimal student learning. Designers should structure activities that help community members distinguish effective practice from pragmatic practice and, where the structure of the schools allows, develop ways to make effective practice practical in their classrooms. In rural schools, lack of resources will demand extraordinary creativity in this regard. But the strengths of rural communities may help to balance this demand.

*Research on Teacher Learning Communities: Implications for Professional Development for Mathematics Teachers in Rural Schools*

Introduction

The need for well-prepared, effective teachers of mathematics is long-standing, but concern about this problem has increased since the adoption in 1990 of the National Council of Teachers of Mathematics (NCTM) standards for mathematics instruction. In rural schools especially, concern has been even intensified further by the requirements of the No Child Left Behind legislation. The NCTM standards call for an instructional approach that endeavors to engage students in thinking and talking about mathematics in a relatively inductive manner. Such an approach requires greater adeptness, flexibility, and spontaneity—and a stronger grasp of mathematics—than do more traditional, procedural approaches to mathematics. The professional and public response to these new standards has been somewhat clamorous, and the controversy surrounding them relates to both instruction and the assessment of mathematics achievement in students. Recent surveys of mathematics teachers indicate that nearly fifteen years after the establishment of the NCTM standards, there is still considerable discrepancy between the types of instruction implied by the standards and the types of instruction employed in mathematics classrooms across the nation. Professional commitment to traditional methods of instruction contributes to this discrepancy. Lack of professional preparation in mathematics content and pedagogical methods, however, may also be an important contributor to the discrepancy between policy and practice. Certainly, mathematics teachers themselves acknowledge a need for better preparation and professional development.

Important new models in professional development, such as situated learning environments and teacher learning communities, represent promising, if only partial, solutions to the problem of preparing teachers and helping them to continue to develop professionally.

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Recent research suggests that preparation and development programs allowing direct observation and emulation of model pedagogical practices, as well as opportunities for collaboration and reflection in a community of teachers, offer viable models for preparing and developing teachers. In addition to addressing teacher shortages, such programs are coming to replace the workshop approach to professional development, an approach that has historically been shown to have little effect on classroom practice. Research on these collaborative models has identified major elements of successful professional development programs. The design and implementation of teacher learning communities should take into account the research on these elements, as well as research on the values and demonstrated benefits and possible shortcomings of model programs, as well as on the kinds of barriers that still need to be overcome. Although few of these studies focus on rural teacher learning communities per se, the findings identify concepts, practices, and problems that are likely to influence the effectiveness of professional development efforts in rural school systems as well as in suburban and urban ones.

### National Standards versus “Really Existing” Mathematics Instruction

The type of mathematics instruction implied by the National Council of Teachers of Mathematics (NCTM) standards differs substantially from the type of instruction many students in public schools encounter. NCTM standards advocate the promotion of engaged learning about mathematics in a classroom community in which students, often through open-ended inductive learning, integrate mathematical ideas into a meaningful framework. According to these standards, lessons should involve students in active problem-solving and creative thinking about mathematics, and in discussion as well as in written reflection on important mathematics concepts and processes. The national professional standards emphasize the importance of



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collaborative work among students and the need for students to develop an informed perspective on the nature of mathematics.

### Survey Results: Status of Mathematics Teaching

In reality, many mathematics classes are taught in a manner that bears little resemblance to the type of instruction envisioned by developers of the national standards. In these classrooms, students typically listen to the teacher's description of new concepts and procedures; then, using the information the teacher has provided, the students complete assigned practice problems in class or as homework. In going over their solutions to the practice problems, students compare their answers and procedures to those of the teacher, who tells them the correct answers and procedures. Textbooks and worksheets are supplemented primarily by transparencies and the overhead projector. Classroom computers, to the extent they are available, are used primarily to reinforce concepts and procedures through practice drills. For students in these classes, there is little difference between how they are taught mathematics and how their parents were taught. This approach to mathematics instruction is widespread, as indicated by a recent national survey of middle-school and high-school math and science teachers (Whittington, 2002a; 2002b).

With respect to mathematics as taught in middle schools, Whittington's (2002a) analysis of the survey shows that slightly more than 50% of the teachers report that they emphasize algorithms and procedures. Although they report that mathematics reasoning objectives are more likely to receive heavy emphasis than objectives relating to basic mathematics skills, the teachers also say that their predominant instructional strategies involve students' answering textbook or worksheet questions and reviewing homework and worksheet assignments. In nearly 80% of their lessons, students were required to complete textbook or worksheet problems and listen to lectures. Although the teachers report that their students work in groups in over half their math

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classes, they also report that individual activities and lecture, e.g. reading textbooks or completing worksheets, accounts for 60% of class time in a typical lesson. According to the survey, in about a third of the classes, students never write reflections. In less than half the classes do students have much opportunity to design their own investigations and work on extended projects. Whittington's (2002a) analysis of the data concludes that middle-school teachers appear to rely largely on rote computational practice to strengthen students' conceptual understanding and reasoning abilities in math.

According to an analysis of the responses of high school teachers to the same survey (Whittington, 2002b), in high school mathematics, too, the predominant instructional strategies involve students' listening and taking notes during teacher presentations, answering textbook or worksheet questions, and reviewing homework and worksheet assignments. These teachers describe working in groups as the most frequently used provision for students to communicate about mathematics, and at the high school level 70% of the teachers report using this strategy at least once a week; nevertheless, high school math teachers report that about 90% of their most recent lessons consisted of students' listening to lectures, participating in discussions, and completing textbook or worksheet problems. Though 56% of the high school math teachers report that they emphasize students' learning how math ideas connect to one another, less than 50% have their students write reflections, and only 32% report that they emphasize students' learning to explain ideas in math. Like middle school students, high school students appear to have few opportunities to design their own investigations or work on extended projects.

Although elementary school practices in general may provide a less routinized approach to teaching mathematics education, by the intermediate grades, mathematics instruction in many schools emphasizes algorithms and computation skills. NCTM standards relating to reasoning, to communicating about mathematics, and to understanding the nature of mathematics seem to have

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little impact on instruction in these schools. Though problem-solving instruction provided in the intermediate grades often includes practical applications, such as computing the prices of items in a store or calculating the time to travel between towns, applications for mathematics relevant for advanced high school mathematics, for a mathematics or science major in college; and for careers in mathematics or science are seldom emphasized (Assouline and Lupkowski-Shoplik, 2003).

Why are these discrepancies between the “best practice,” as implied by national standards, and actual classroom practice so prevalent? One clear reason for the discrepancies is a committed belief on the part of many teachers and researchers in the greater efficacy of a more traditional approach to mathematics instruction. Many parents and professionals regard the NCTM standards and the methods associated with them as potentially undermining students’ acquisition of important mathematics skills. One of the most outspoken groups, associated with the website, “Mathematically Correct,” regards the national standards as de-emphasizing skill development and the memorization and practice that group members regard as essential for high achievement in mathematics (Loveless, 2001). Though some educators are staunchly opposed to the NCTM standards, some simply believe that more research is needed to demonstrate the effectiveness of the methods implied by those standards.

Questioning the relative effectiveness of the national standards is related to another area of disagreement, the relative validity of different types of measures of mathematics achievement. Traditional achievement tests tend to draw mostly heavily on procedural knowledge. On the other hand, assessment techniques that lend themselves to some of the non-procedural NCTM standards probably cannot demonstrate the statistical validity associated with traditional standardized tests. Establishing the validity of qualitative assessments, such as portfolios, in meaningful quantitative terms is virtually, if not logically, impossible. The issue for state

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departments of education and local school districts, then, is whether and how state and local assessments should be changed to measure effectively the kinds of knowledge implied by the national standards. The answer to this question depends, to an extent, on what kind of mathematical knowledge the populace, at least the politically powerful segment of the populace, thinks is most important for public school children to learn. It seems plausible that the relatively conservative school boards typical of rural communities favor traditional math instruction and assessment, as they are reportedly less supportive of innovations than school boards in suburban and urban communities (Smith & Lotven, 1993).

Another reason for the discrepancy between classroom practice and national standards is that traditional instructional methods are familiar, simpler, and consequently less time-consuming in terms of preparation for instruction than the methods associated with the NCTM standards. Because they are less time-consuming in terms of both instruction and grading, traditional methods may lend themselves more readily to the introduction of the large number of mathematical concepts and procedures that mathematics curricula, particularly as manifest in state education standards, often dictate—a breadth of coverage made problematic because of the relatively little time devoted to mathematics in many elementary, middle, and secondary schools.

Given the familiarity and relative ease of traditional methods, another possible reason for heavy reliance on traditional methods is a lack of adequate professional preparation in mathematics and in pedagogical theories, strategies, and research. While opponents of NCTM standards construed California's failure to bring about math reforms in the public schools as evidence of the standards' inappropriateness, David Cohen, professor of education and public policy at the University of Michigan, instead attributed the failure to a lack of well-coordinated, effective professional development ("Experts," 2002). According to Cohen, the reforms were effective in classrooms where teachers had a chance to learn the new curriculum thoroughly.

### Status of Professional Development in Mathematics

There is considerable evidence that professional development for teachers and prospective teachers is inadequate, even where the issue of adherence to NCTM standards is not of primary concern. An editorial in the *American Institute of Physics Bulletin of Science Policy News* (FYI, 2000) asserts that the current system for preparation and professional development of K-12 science and math teachers needs improvement on a large scale. It reports that many teachers do not have adequate content knowledge to teach these subjects effectively. Moreover, it says, beginning teachers do not receive the support needed to improve and refine their content knowledge and pedagogical skills.

In general, math and science teachers are more likely than other teachers to lack an undergraduate degree in their teaching field (Hoff, 2002), but inadequate preparation to teach mathematics seems more prevalent at the middle-school level than at the high school level. Whittington's (2002a; 2002b) analysis of the aforementioned recent survey found that though 63% of middle-school math teachers have taken eight or more courses in math, 74%—compared with only about 23% of high school math teachers—do not hold either an undergraduate or graduate degree in mathematics or mathematics education.

### Qualifications of Teachers in Rural Schools.

Rural areas struggle to recruit qualified teachers because their salaries cannot compete with the higher salaries offered by most urban and suburban school systems (Tyler, Cantou-Clarke, Easterling, & Klepper, 2003). According to the 2002 report from National Center for Education Statistics (cited in Williams, 2003), rural teachers are paid, on average, 13.4 percent less than their urban and suburban counterparts. This also makes retention especially difficult

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for rural schools. In Illinois, for example, the average difference between the highest rural and nonrural salaries is \$33,761 (Jimerson, 2003). Although that difference is dramatic, even smaller differences in the salaries typically associated with the greatest seniority and expertise, such as the \$7,425 gap in North Carolina, can be significant (Jimerson, 2003). Given these differences, it is not surprising that rural school systems, such as those in southern Appalachia, report that the percentages of academic core classes taught by teachers with no major or certification in the academic discipline they teach are higher than the national average. Kentucky's Department of Education, for example, reports that 21.7 percent of the state's public secondary school mathematics classes are taught by teachers with no major or certificate in math (Williams, 2003).

### Teachers' Recognition of Professional Development Needs

Whether or not they hold mathematics or mathematics education degrees, most math teachers recognize a need for continuing professional development. Eighty percent of middle-school teachers and 67% of high school teachers surveyed report at least a moderate need for professional development in the use of technology in math instruction, for example (Whittington, 2002a; 2002b). Nearly half the middle school teachers who were surveyed cite a need for more professional development on understanding student thinking, while just over 30% say they need professional development to deepen their mathematics content knowledge. More than half the high school teachers surveyed report a need for professional development in learning how to use inquiry-investigation-oriented strategies, and more than half report needing to learn how to teach math in a class that includes students with special needs.

Whittington's analysis also suggests that professional development efforts are (1) infrequent and (2) often ineffective in changing teachers' classroom practices. Of the middle school and high school teachers surveyed, more than half report having spent fewer than 35

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hours in mathematics-related professional development in the previous three years. Only about half the teachers report collaborating with teachers locally—including observing their classrooms and meeting regularly to discuss issues related to mathematics teaching—as professional development activities in which they had participated during the previous three years. Fewer than one-third of the middle school teachers of math report attending a state or national mathematics teachers meeting, compared with about 40% of the high school teachers. Twenty-four percent of the middle-school teachers and 55% of the high school teachers completing this survey in 2000 reported that they had taken no mathematics courses since 1990. The teachers' responses on the survey show that inservice workshops are by far the most frequently used method of professional development.

The shortcomings of workshops in regard to changing teachers' classroom practice significantly are well documented (e.g., Hendrickson & O'Shea, 1993). Although the last decades have seen improvements, persons other than those who are to participate in the workshops too often decide their content; and, understandably, workshop participants often are unconvinced of the usefulness of that content. Moreover, even when the participants perceive the content as useful, follow-up is seldom provided to offer encouragement, guidance, or evaluation of teachers' application of the workshop concepts in the classroom. According to Whittington (2002b), only 40% of math teachers at the high school level in the recent survey report that they changed their classroom practice as a result of their participation in professional development activities that emphasized technology, and the percentages are even lower in other areas of math instruction, such as learning how to assess student learning in math (only 15% say they changed their classroom practice); learning how to teach math in a class that includes students with special needs (only 13% say they changed practice); and deepening their own math content knowledge (again, only 13% report that the new knowledge changed their classroom practice).

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Many professional development programs for teachers of mathematics fail in a number of ways. They fail to provide teachers training within the context in which the new skills and knowledge are to be used; they fail to focus on teacher behavior in their classrooms; they fail to respond to the interacting array of skills and dispositions that compose standards-based practice; they fail to take into account important factors affecting teacher behavior; and they fail to evaluate teachers' application of their new understanding and skills in the classroom (Kimmel and Fadi, 1999). Until such problems are addressed, it is impossible to determine whether the continuing discrepancy between national standards and local practice derives primarily from informed professional differences of opinion or values; from conscious election of methods that are perceived as more efficient for providing broad coverage to a large number of students, i.e. are more compatible with mandates of the local curriculum in combination with scheduling constraints; or from lack of knowledge and skills related to the standards.

### Professional Development as Learning Situated in a Community of Learners

Many attempts have been made to design and implement more effective professional development programs for teachers and for prospective teachers. One of the commonalities of these many efforts in recent decades is a concern to provide "situated learning." This term is associated with the growing prevalence of a sociological perspective on learning over the more psychological approach that dominated education in the mid-twentieth century. The concept of situated learning is associated with a pragmatic, reflective, and interactive approach to education. Influenced by the philosophical ideas of Dewey on education and Wittgenstein on language, among others, in the first half of the twentieth century, and Derrida and Foucault, among many others, in the latter half, sociologists, educators, and even psychologists, have come to accept more widely the idea of learning as a social enterprise and of knowledge as a social production.



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The expansion of field-based educational experiences and the formalization of professional learning communities are among the most widespread efforts to provide learning experiences in a context that is analogous to the one in which teachers' functions are carried out.

### Situated Learning and Field-Based Education

Brown and Duguit (1996) note that, in the traditional view of teaching, knowledge is transmitted (or not), unchanged. In the traditional view, the learner is competent or not in being able to receive the knowledge; the teacher is competent or not in transmitting it. In describing their preference for situated learning of pedagogical concepts and methods, Brown and Duguit assert that in the on-campus university classroom, prospective teachers are confronted by what is necessarily only a partial account of pedagogical practice and how to apply theory and research in teaching elementary and secondary level students.

This perspective on teaching and learning is the basis of the ubiquitous instructional objectives (e.g. Mager, 1984), which have been employed at every level of instruction in the United States for over half a century. In the traditional approach, instructional objectives, often drawn from a scope and sequence curriculum composed of long lists of such objectives, are task analyzed into sub-objectives, or more specific objectives that can be taught within the intended timeframe of a lesson or unit of instruction. Major concepts to be learned are also analyzed, then defined in terms of their distinguishing attributes so that the concepts can more readily be learned by students. The entire instructional process for each lesson is planned by the teacher in an effort to help students accomplish the objectives specified by the scope and sequence curriculum. This tradition views teaching and learning as inherently "decomposable."

A situated learning perspective, on the other hand, considers learning to be a continuous process of active appropriation by the student, an appropriation of concepts or skills that may

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have little to do with what the instructor hopes to teach. This condition remains even if there are broad instructional objectives or goals that influence the choice of the particular material being taught. Where traditional approaches to teaching require precise planning and control of detail, situated learning approaches emphasize the provision of a realistic context, modeling by expert practitioners, apprentice-type activities by the students, and periods of reflection on the prospective teachers' experiences in the elementary or secondary classroom (Brown & Duguit, 1996). Field-based programs for teacher preparation often provide opportunity for reflection on classroom experiences in an after-school seminar guided by a university professor or an adjunct professor who is a working schoolteacher. A field-based program demands of a breadth and depth of both content and pedagogical knowledge sufficient to enable the instructor or facilitator to raise meaningful questions and to respond astutely to the questions and issues that prospective teachers raise during the reflective seminar, as well as to provide feedback on the classroom practices observed or conducted by the prospective teachers.

Whether teachers subscribe to traditional methods of teaching or to the NCTM standards, many of them agree that teaching mathematics requires pedagogical and mathematical knowledge that allow improvisation, depending on students' responses to instruction. The deeper their understanding of pedagogy and math, the more apt teachers' improvisations are likely to be (Heaton, 2000). Field-based education, grounded in sound theory and research, offers the advantage of ready opportunity to apply new pedagogical concepts and skills, including improvisation, in the context of the classroom. Situated learning seems on the face of it to be ideal for the transfer and application of pedagogical concepts and skills.

Field-based education programs have been increasingly used in undergraduate and in graduate education for the past twenty-five years or so, despite many barriers—primarily cost, but also institutional disincentives and philosophical differences among professionals from different

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groups. One of the primary benefits of field-based education is the early introduction of prospective teachers to the classroom and school so that they can observe directly how the ideas presented in their textbooks or lectures are applied or play out in real life. This learning environment in the elementary or secondary school is thought to offer a richer learning experience than the mid-twentieth century model of teacher education, which consisted of three years of on-campus courses and relegated situated learning to the senior-year student teaching.

Another major reason for the higher demand for field-based programs is the shortage of teachers in rural areas. Especially since the passage of the No Child Left Behind legislation, concern about the shortage of qualified teachers has greatly intensified as rural school systems try to meet the teacher-quality requirements of the law. Among their efforts to address this new mandate, rural schools, rural communities, and universities are collaborating with each other, which not only provides situated learning but also makes it easier for locals to complete certification requirements without driving long distances to university campuses (Williams, 2003).

Common among these collaborative efforts in rural areas are professional development schools, such as those initiated by Southeast Missouri State University and local school systems in the high-poverty Ozarks region (Williams, 2003). The importance of these schools is suggested by the West Virginia legislature, which passed House Bill 4669 in 2004 to establish five-year demonstration professional schools in public schools with significant enrollments of disadvantaged, minority, and underachieving students. These model professional schools are expected to develop collaborative strategies that can be replicated in other West Virginia school districts.

Professional development schools typically link universities and public schools or school systems in a cooperative personnel preparation program so that prospective teachers enrolled in

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the university are placed part-time in the same school or school system for their entire teacher-preparation program (e.g. Mebane & Galassi, 2003). Prospective teachers in professional development schools, and sometimes in other field-based programs, are organized as cohorts according to their date of entry to the program, each cohort constituting a learning community of students preparing to become teachers. Each cohort learns within the larger learning community of the elementary or secondary school. Such programs provide a unique opportunity for continuity of learning. One program that borrows from the professional development school model, for example, is at Indiana University-Bloomington. It extends across multiple classrooms and schools; provides school-based apprenticeships to teacher-candidates attending the university; and offers seminars that students facilitate, allowing them to reflect on their experiences (Buysse, Sparkman, and Wesley, 2003). These students are involved with the same school for the duration of their preservice program, and as graduates, former students continue to be involved in seminars and as mentors. Collaborations between university and public school faculty in professional partnerships, such as professional development schools, encourage improvements in personnel preparation programs, in large part through feedback from experienced public school teachers. The teachers provide input regarding personnel preparation needs arising from new legislation, gaps in current preparation program curriculum, and changing public-school student populations or classroom/school configurations.

The adoption of the field-based framework for professional development for current teachers reflects conviction about the importance of learning pedagogical skills within the context in which they're to be used. It also reflects, however, that the idea of the school as a community of learners is expanding. In fact, with practicing teachers, creating a learning community element as part of professional development has perhaps taken priority in importance over ensuring that professional development involves situated learning. At any rate, field-based

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approaches to professional development address the problems specifically associated with the workshop approach: lack of teacher input to training, lack of relevant content, and lack of follow-up support to help ensure adoption of new concepts and practices. Formalizing and promoting teacher learning communities also addresses the problem of isolation that tends to keep apart teachers of each academic discipline, e.g. mathematics, at the secondary-school level, particularly in rural communities. They address, too, the problem that for many teachers working conditions inhibit reflection on practice (Kilpatrick & Silver, 2000). Professional development that is field-based and focused on teachers as a community of learners typically incorporates in its design research and theory associated with the concept of “communities of practice,” a concept first applied in business contexts.

### Communities of Practice

In their influential book, *Situated Learning: Legitimate Peripheral Participation* (1991), Jean Lave and Etienne Wenger contend that learning any practice involves a deepening process of participation in a community of that practice. Their analysis of this learning process has made the concept of community of practice an important focus of organizational development in private and public institutions. Lave and Wenger claim that as praxis is shared to a significant extent among members of communities of practice, new members learn to talk and behave in ways that make sense within their particular community. This model is a variant of experiential learning, but it emphasizes the normative function of the community. According to Lave and Wenger’s theory, the interpersonal interaction within the group—through confirmation in discussions, collaboration, and other interactions—does not merely accelerate learning; it is essential to effective practice. According to their model, teaching and learning in the community are bi-directional; even experienced members of the group gain new insights through interactions

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focused on practice. Theoretically, the “social capital” residing in communities of practice leads to behavioral change that results in greater gains in knowledge than would individual learning efforts, and consequently has a highly positive influence on group performance.

The community of practice model for professional development has been used to establish learning communities across levels of expertise—from preservice teacher-candidates, to university professors, to practicing teachers—as well as within them. In communities of practice that have been formalized for professional development purposes, shared inquiry and learning focus on issues, dilemmas, and ambiguities that emerge from actual situations in authentic practice settings; application of knowledge, not its retention, is the criterion used to evaluate the effectiveness of learning activities (Buisse et al., 2003). Importantly, the community of practice model offers a means of generating new knowledge and practice through collaborative research. For teacher preparation and for professional development of teachers, the most essential principles of the community of practice concept are that (1) knowledge is situated in experience and (2) experience is best understood through critical reflection with others who share that experience (Buisse et al., 2003). According to these precepts, teachers who constitute communities of practice can learn more about mathematics and how to teach mathematics than they could learn in more traditional professional development efforts, such as university classrooms or workshops; and in the process, they can generate new ideas about these subjects.

Viewed through the community of practice lens, the gap between university classrooms and the didactic goals of education often looks extreme. Abstractions provided in on-campus courses or in workshops can provide crucial clarification only if they can be made relevant by practice. Because of this, and because interpersonal interaction is disrupted in the classroom and community is limited, in Lave and Wenger’s view, the workplace is the best setting in which to design limited peripheral participation and related learning. In arguing the advantages of the

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community of practice model, Brown and Duguit (1996) point out that relatively little of the complexity of actual practice can be made the subject of explicit instruction. They assert that the university classroom is too “theft-proof,” or sterile, to provide concepts that can be applied to practice. In a community of practice model, teachers as learners are provided a rich enough learning experience that they can “steal” what is most salient to them at that moment of their learning process, and an experience in which they can see increasingly greater depths, through their active participation in collaborations with other, perhaps more experienced, members of the community (Brown & Duguit, 1996).

According to Lave and Wenger’s model, the university classroom does not constitute a community of practice because it does not consist of persons who perform a similar role; therefore, it cannot offer an effective setting for learning professional practice. Even when professors consider themselves as learning with their class, their incentives are so different from those of the students as to militate against the kind of dynamic typical in communities of practice. Additionally, the fact that abstractions and explications in the teacher-education university classroom are detached from the practices to which they are to be applied and, in many cases, from which they were originally drawn tends to lead to learning problems (Brown & Duguit, 1996). Shared reflecting on practice is a major theoretical underpinning of the community of practice model for integrating research and practice. From the literature on reflective practice comes not only a rationale for reflection as a means of individual improvement, but as a means of improvement of the system in which the individual practices. According to Schon (1973), the opportunity for learning that can improve the way a system works is greatest at the periphery, rather than at the official, or administrative, center of the system. Teachers, rather than administrators, have the most to offer schools if they are allowed to reflect on their practices and if the new learning they generate is incorporated into system-wide

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practice. Schon says that reflection is an ongoing process of critically evaluating current and past professional practices against an overarching philosophy of practice. An important part of reflection, however, is to recognize when it is imperative to look beyond immediate problems *within* structures of a system, and discard the *structures* that make some problems insoluble (Schon & Argyris, 1978). With this principle in view, many educators contend that fully realized learning communities may demand a restructuring of the school, replacing centralized leadership with distributed leadership, for example (Harris, 2003).

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A community of practice is a community that learns, but the concept of learning communities in education refers to groups that are different in their basic purpose. Haberman (2004), speaking of schools as learning communities, defines a group as a learning community when members share a common vision of students' learning as

- the *primary* purpose for their association,
- the ultimate value to preserve in their workplace, and
- the ultimate demonstration of the success of the community's work.

Members of such "learning communities" believe that improved student achievement is the primary criterion for evaluating the success of the community's work. Teachers who work together in a school would necessarily be a community of practice, but they might not be a "learning community," or even part of one, in the sense that Haberman means.

Harris (2003) asserts that the term "professional learning community" implies that the school culture emphasizes professionalism in being student-oriented and knowledge-based; that it values teachers' professional development, and that it emphasizes personal connection among teachers. Harris suggests that it also assumes a culture in which school leadership is concerned



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with the social and intellectual ends of schooling, rather than more instrumental ends. The term “professional learning communities” is used in a number of senses: it may refer to a small group of three or four teachers within a school or an entire faculty, or it may even refer to teachers who are connected over long distances by computer technology (Rolff, 2003). Professional learning communities may meet frequently or infrequently. Although research indicates the success of many such groups, Rolff notes that it is questionable whether they can succeed without clear definition of purpose and without adequate support from the school administration, at least in terms of validating goals and creating scheduling conditions that allow for group meetings. Other researchers agree on the need for time—not only for community members to meet, but also to observe each others’ teaching—as well as support in terms of incentives, communication structures, and, especially, policies that provide teachers more autonomy (Boyd, 1992; Louis and Kruse, 1995).

Haberman’s (2004) attributes of a schoolwide learning community could apply to the design of teacher learning communities as well. A professional learning community of teachers involves its members in modeling appropriate practices, sharing ideas, collaborating for the sake of learning and community, striving for high productivity, and purposively applying what is learned. In order for schools to constitute meaningful communities of learning, DuFour (2004) argues that three basic ideas must govern the learning community enterprise or it will be doomed to become just another education effort that, after much initial excitement, succumbs to a general confusion about the meaning of fundamental concepts, and then to widespread problems in implementation. DuFour identifies three core principles of learning communities:

- ensuring that students learn—not just that they are taught;
- creating structures to promote collaboration of effort; and
- focusing on results, in terms of improved student achievement.

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To those three, Schlager and Fusco (2004) add a fourth: that professional learning communities dedicated to acquiring and generating knowledge demand a long-term, open-ended commitment.

The learning that goes on in teacher learning communities is generally construed to include research with other educators, including university researchers. Brown and Duguit (1996) contend that, in contrast to action research models and professional development school models, the teacher learning community model offers greater promise for changing the linear relationships through which information has been traditionally handed down in teacher education. Teacher learning communities, they say, can effect a fundamental change in how practitioners and researchers establish mutual trust and sustain long-term relationships.

Brown and Duguit (1996) also view *perspective* as another important feature to consider in the design of teacher learning communities. To be most effective for learning, the system in which a learning community operates needs to be broadly construed. The “system” in the narrow sense of a school or school system needs to be connected to the broader systems—the material, technological, and social systems in which the smaller system is embedded. Such a construal enables teachers and prospective teachers to know better what to appropriate for his or her professional development

### Critical Perspectives on Situated Learning

According to Brown and Duguit (1996), situated learning in the elementary or secondary mathematics classroom gives prospective teachers a chance to “steal” whatever they find most relevant. Though these authors suggest the superiority of situated learning for educating teachers, other educators suggest some necessary cautions to keep in mind when designing situated learning experiences for teachers. Wenger (1998) argues that those things necessary to make the practice *contingently bearable* are also part of the practice (i.e., according to McLaughlin [2003],

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Wenger acknowledges that practices may embody and reproduce prejudice and injustice as well as what are regarded as moral behaviors). Smith (2003) observes that a community of practice represents a “dynamic tension among a range of influences and forces,” and in culturally heterogeneous schools especially, there is a need to continually renegotiate the ethos of the community (p. 466). Smith sees this ethos as determined in large part by the values, attitudes, and behaviors the members bring to work and formal expressions of the goals of that work, e.g. curriculum standards, graduation rate goals, achievement level goals, and policy statements.

One major problem designers of teacher learning communities must consider is that in field-based or situated learning, much of the practice students and new teachers are likely to learn will serve the socioeconomic and political status quo, rather than being practice grounded in research and demonstrated to effectively improve student achievement. Marsh’s (2002) case study of a new teacher indicates how one school’s discourse of normalization judged all children by comparison to a white, middle-class standard that identified any mismatch between children’s behavior and the norm as problematic and as resulting from a deficiency in the children. The teachers generally interpreted this “deficiency” in developmental terms—i.e. the children were not “ready” for particular academic or behavioral demands—or in terms of the children’s supposed emotional or learning difficulties. According to Marsh, though the new teacher started out intending to use a child-centered approach to education, she soon changed her approach to a highly teacher-directed, authoritarian approach more in keeping with the school’s emphasis on conformity to rigid and racially biased standards for behavior.

It seems likely that some of the complaints about on-campus university courses and the research and theory taught therein, complaints that serve as part of the rationale for a greater emphasis on field-based learning, may reflect the mismatch between elementary and secondary schools’ overt goal to improve all students’ achievement and their covert goal: to maintain the

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status quo. Theoretically sound practices that contradict the interests of the privileged may indeed be difficult to implement within the structure of practice in the schools. Teachers who struggle to carry out these theoretically sound practices may understandably come to discount them as unrealistic, or even irrelevant. A portion of student-teachers' and teachers' dissatisfaction with what they learn in their on-campus university courses may stem from this conflict between best practice and practice that serves ends other than students' academic achievement. In an assessment of a university field-based program for teacher preparation, Hayes (2002) found that the university students saw a disjuncture between practices they observed in their classroom placements and the practices that were proposed in their methods course. Hayes poses the important question as to whether such a discrepancy is a problem or should be considered a productive source of tension that can lead to change in instructional practice.

Without an awareness of this potential conflict and the need for efforts to address it, including emphasis on the importance of all learners' success, field-based education and other professional preparation and professional development efforts situated in the schools may repeat patterns of injustice. In the context of the contradictory political motives behind school practices, prospective teachers and current teachers may find it easy to dismiss as impractical ideas that might help students, but that do not fit readily into current school practices or informal, unwritten policies. Moreover, it seems important to consider—in order to guard against it—the possibility that a focus on local classrooms and methods may limit prospective and current teachers' opportunities to challenge seriously the way things are currently done and may lead to the kind of parochial, “common sense” knowledge that often serves to maintain a status quo of inequity and mediocrity.

This caution seems particularly important in professional development for mathematics teachers because, of all students' academic skills, mathematics skills may be the most prone to

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suffer from anemic instructional practices, since mathematics skills and knowledge are seldom reinforced outside formal schooling. Students may read for pleasure at home, thus improving their reading skills and their knowledge of many subjects. They may watch movies about science or history; but they are much less likely to encounter mathematics in a recreational format.

Hobbies that use applied mathematics, such as amateur radio, music, and rocketry, are available primarily to relatively privileged children. The habit of doing puzzles of various sorts is also much stronger among privileged than under-privileged families.

Tennant (1997) argues that advocates of learning community approaches to education show an overeagerness to debunk paper and pencil testing, formal education, and formal accreditation, and to omit consideration of important issues of power relationships, public knowledge, and public accountability. Similarly, some contend that proponents of the learning community model exaggerate the claim that decontextualized, abstract knowledge is not helpful; thus, its proponents' claims that people learn best with the learning community model may need strong qualifications (Tennant, 1997). Arguably, the types of concepts and skills to be learned ought to determine the most effective methods. On the face of it, instructional method lends itself most readily to situated learning as, perhaps, does instruction designed to integrate content and pedagogy.

Is pedagogical theory taught best in field-based settings and teacher learning communities? Is mathematical theory taught best in such settings? Does the "ivory tower" of the university campus serve some learning purposes better than does the public school setting? Research has by no means answered these questions, and it seems crucial to the professional development enterprise to determine more clearly what type of learning is best suited to field-based and learning community frameworks.

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### Designing and Implementing Professional Learning Community Programs

Although it may be true, as Schlager and Fusco (2003) claim, that becoming a competent practitioner is possible only by actually engaging in practice and discussing issues within that context, use of such an approach does not, of course, guarantee competence among participants. A learning community can certainly be dysfunctional, and, as suggested above, the learning that takes place does not necessarily lead to more effective instructional practice.

Perhaps the most common cause of dysfunctional learning communities is the lack of adequate incentive to participate and, related to this problem, the lack of adequate time to meet and work together. Weak learning communities may have difficulty having any effect on practice, but even strong communities can hinder improvement in the members' instructional practices by resisting productive change. As with any field, learning more about math and how to teach it can be undermined through inaction or through actions that subvert effective practice. A learning community may decline to support some innovations if its practitioners don't care about research, perhaps because they perceive that educational research has failed to address relevant problems or generate useful solutions.

That indifference to research may be the biggest obstacle to the development of research-practice partnerships with faculty from colleges of education (Buysse et al., 2003). Research on teacher learning communities suggests that several important factors must be taken into account in implementing professional development programs in order to heighten participation and interest in activities that promise to help in improving student achievement.

### Important Elements of Professional Development Learning Communities

Any engaged professional educator who devotes time to an activity will first consider whether the activity is meaningful. Teachers who regard an activity as irrelevant, impractical, or

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uninteresting, will be unlikely to participate voluntarily and will resent being forced to participate. Although teacher learning communities employ a relatively democratic approach to professional development, one that is based in large part on teacher interests and needs, there is nevertheless some evidence that trusted, task-oriented administrators can enhance the effort by validating the community's goals as well as actively engaging as a facilitator of some of the teacher learning community activities. Research also shows that teachers find most helpful those professional development activities that integrate content and pedagogy, as well as those that provide opportunities for collaboration and for reflection on practice, including practice to integrate new content and pedagogy. The design and implementation of learning communities also must consider, in addition to the influence of technology and of school culture, the contribution that individual biography makes to the community effort.

### Meaningful Work, Trust among Community Members, and Facilitative Leadership.

Few empirical studies either document the impact of professional learning community collaborations on the participants or identify the variables associated with that impact. An exception is a study by Mebane and Galassi (2003) of middle school and university educators involved in collaborative inquiry partnership groups, which found three variables that contributed significantly to the groups' perceived learning. Their questionnaire, completed by 68 participants in twelve inquiry groups, found that of six group-process variables and five task variables, only *task-oriented leadership style*, *cohesion* (feeling of acceptance by and comfort with the group), and *importance of the task* correlated significantly with the participants' perception that they were learning in their group. The researchers conclude that (1) the presence of task-oriented leaders—who provide structure for the group's work, make suggestions, and help define role responsibilities, for example; (2) the participant's feeling of being accepted and

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involved in the group; and (3) the participants' perception that the group's task is important were all uniquely instrumental in explaining variation in team learning. They note that their findings that task-oriented leadership and cohesion were significantly related to group perceptions of growth are consistent with results of other studies of group dynamics. The results of other studies related to community learning in education are also consistent with their findings.

Carver (2004) describes Club Maroon, a professional development learning community in an under-funded urban high school in Kalamazoo, Michigan. According to Carver, Club Maroon's success results from a meaningful work agenda and from mutual trust. Club Maroon offered regularly scheduled in-house meetings every other week that were focused on improving student achievement and devoted to tackling real problems of practice in that school. Most meetings focused on addressing immediate needs or concerns, but they also reflected the group's long-term purpose to be more effective in improving the achievement of students in the school by giving new teachers a safe space for reflection and a team approach to helping each other succeed. The teachers sometimes observed each other in the classroom, and their discussions reflected their comfort with critical reflection on their own practice. Another element of the group's success may have been that participants could elect to receive credit toward their mandated district professional development hours for their participation in Club Maroon. As with any work, learning community work can be meaningful in terms of its apparent worth for the participants' goals, but it can, to a lesser extent, also acquire meaning through external rewards, such as credit for participation.

Costa and McLymont (1998) describe another model that uses an experienced practitioner as facilitator and fosters reflective practice. This case study focuses on four math teachers at one school who participated in a two-phased seminar series. The teachers considered techniques in reflective coaching discourses and then translated the results of their reflections



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into their own mathematics teaching and learning in the classroom. Their approach was a kind of cognitive coaching that made use of specific learning strategies in a nonjudgmental environment, built around a collaborative reflective planning conference. According to Costa and McLymont, the process both builds trust and makes use of a critical, trusted friend. The principal's support, the coaching approach, reflective thinking, a comfortable atmosphere, an atmosphere of trust, and a collaborative, nonjudgmental context were all identified as necessary for the group's success.

Administrative staff members who play a facilitative role in a learning community may influence its effect on the practitioners' professional growth. In the Club Maroon project, for example, the dean of students attended the meetings as an important function of his role in supporting and helping teachers meet the demands of their new job and learn how to navigate the bureaucracy of their large, urban district (Carver, 2004). The members appeared to value the participation of a representative of the administration. So, too, did teachers in the North Carolina Lighthouse Schools Study, who reported that their grade-level team meetings to reflect and analyze their teaching were helped by an energetic leader. One of them commented in response to evaluation questions: "We have a curriculum facilitator who helps keep us organized and focused" (Goddard, Hoy, & Hoy, 2000, p. 136).

In an urban California elementary school, researchers (Hollins, McIntyre, DeBose, Hollins, and Towner, 2004) found a difference when the person assuming the role of facilitator changed. First a university graduate student and later the principal served as facilitator for the teacher learning community's meetings. Not surprisingly, the participants in the teacher learning community seemed to feel that the principal's participation validated their group work; their interest and motivation seemed to increase as a result of the attention the principal gave the study group.

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Based on their experience in the business world, Van Winkelen and Truch (2004) recommend that designers of learning communities determine an appropriate subject area for the community, establish a clear purpose, ensure the fulfillment of certain roles, and obtain appropriate organizational support. In education, the “appropriate subject area” for the community will be intimately linked to the community’s purpose. As Lewis, Ketter, and Fabos (2001) point out, leaders’ roles are problematic, and so it remains clear that task-oriented leadership can be an important element in validating the community’s work and in supporting it.

Williams (2003) suggests that consideration of place-based education has the potential to increase the learning community model’s effectiveness in rural schools by heightening the meaningfulness of the curriculum and of curriculum-related professional development. Williams also finds that offering teachers extensive training as leaders plays an important role in advancing the learning community enterprise in rural schools.

### Opportunities for Reflection

According to many observers reflection plays a key role in improving professional practice (e.g. Emery, 1996; Marsick and Watkins, 1994). Virtually all of the professional development community models identify the opportunity for ongoing reflection on teaching as an important part of their development effort. Accordingly, the National Council of Teachers of Mathematics has created a professional development program entitled “Reflections,” based on the premise that analyzing lessons can help lead to new mathematical understanding and teaching insights. This program offers online video examples of math instruction. Individually or in groups, teachers reflect on the lessons and on their own skills and lesson plans (Ezarick, 2001). The website for “Reflections” lists several steps as critical to the process: reflecting on the task that was presented to math students; reflecting on the discourse in the classroom and the

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environment that discourse helps create; reflecting on pedagogical decisions; and reflecting on the nature of the mathematics being taught (“About Reflections,” 2004).

Reflection based on information about student achievement may prove particularly valuable for some learning community activities. Analyzing teacher interviews, Strahan (2003) concluded that the faculty at three elementary schools in North Carolina developed supportive cultures that in turn enabled participants to coordinate their efforts to improve instruction and strengthen professional learning communities. The central dynamic in this development is described as “data-directed dialogue,” purposeful conversations guided by formal assessment and informal observation of students in the schools.

Buyse and colleagues (2003) also describe a teacher learning community established to (1) enhance early literacy activities and (2) examine the efficacy of the community of practice approach in enhancing professional development. General and special education teachers, curriculum specialists, and researchers met monthly for one year. Each meeting provided a framework for reflection and critical thinking , e.g. journaling, work time, reporting out. The community identified individual goals or projects to implement in classrooms and shared ongoing teaching experiences and dilemmas in their meetings. This program was part of a district-wide initiative to include research as component of professional development; the district provided release time to meet. One teacher began a guided reading project in her school that resulted in a school-based action research study.

### Integrating Content and Pedagogy

For education reforms in math to succeed, teachers must be immersed in the subjects they teach and be able to promote basic knowledge as well as advanced thinking and problem solving in their students (Herman, Desimone, Porter, Birman, & Garet (1999). Not surprisingly, many of

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the professional development efforts of teacher learning communities often pair mathematical concepts and skills with science concepts and skills.

Basista, Tomlin, Pennington, and Pugh (2001), for example, describe an inquiry-based integrated science and mathematics professional development program developed through the collaborative efforts of math and science educators from Wright State University and from Trotwood-Madison and Huber Heights school districts in Ohio. Funded by the National Science Foundation's Eisenhower Professional Development Programs and Project GROW, the program for teachers consisted of a four-week intensive summer institute and, during the following academic year, five follow-up seminars and five classroom visits as well as support for adoption of learned practices. The summer institute provided a cooperative learning environment and made use of inquiry activities to study such mathematical topics as rates of change; proportional reasoning; and graphing, tables, and charts. The institute emphasized helping learners explain their reasoning and support their conclusions. During the following year, teachers completed a portfolio to document their incorporation of inquiry activities. On an evaluation questionnaire, 97% of the participants reported that the institute improved their content knowledge in science and mathematics; and 85% said they believed that the summer institute improved their skills in using inquiry. According to Basista and Matthews (2002), if professional development learning communities are to successfully improve teachers' effectiveness in working with their students, they must provide experience in effective classroom approaches—particularly inquiry and cooperative learning—that stress hands-on learning. Basista and Matthews claim that preservice teachers especially should have opportunities to observe science and math content integrated with pedagogical content.

Buysse and colleagues (2003) describe a learning community composed of a group of K-5 teachers, a science teacher, doctoral students, and researchers. The group's purpose for

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collaborating was to examine and improve science teaching practices through Guided Inquiry Supporting Multiple Literacies, an interdisciplinary, inquiry-based approach to teaching science. The teacher-participants developed their own agenda for their programs. This group's professional development effort consisted primarily of practicing the guided inquiry approach during a two-week summer program and twice monthly for one school year. They planned and practiced teaching strategies in teams, videotaped their use of the inquiry strategies, and then critiqued each other's performance by analyzing the taped instruction. During their meetings, they reflected on ongoing teaching experiences and dilemmas in order to expand their strategies. They also initiated two study groups: a writing group and a Vygotsky reading group. The participants in this professional development community were very supportive of this model (Buysse et al., 2003).

### Collaborative Practice

Kimmel and Fadi (1999) describe a model of professional development designed to improve the skills and knowledge of teams of special education and regular education teachers in science, mathematics, and technology instruction. The model included summer and academic year content- and methodology-focused workshops and summer "practicum" experiences in a classroom of students with disabilities. Three successive cohorts of elementary and middle school teachers were selected to participate through a self-nomination process and principal recommendations. The training component included opportunities to learn about collaborative teaching, to upgrade knowledge of math and science, and to expose participants to alternative approaches to teaching math and science to special education students.

According to a survey of math and science teachers nationwide (Whittington 2000b), high school teachers indicate a need to learn more about how to include special education

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students in classroom academic activities. Meaningful professional development requires taking teachers' needs into account, and providing assistance in inclusion appears to be a priority for professional development. Pertinent to the issue of teacher learning communities is the collaborative approach that serving special education students demands. This model of instruction reinforces the collaborative nature of professional development activities in a learning community approach. Kimmel and Fadi describe a program that exemplifies many elements important for success; it was based on the assumptions that change in teacher behavior is a gradual process; that regular feedback to teachers is necessary for maximal learning; that opportunities for reflection and discussion with peers should be provided regularly; and that continuing support for teachers' efforts to improve is essential. The summer program emphasized collaborative teaching by general and special education teachers. A seminar offered opportunity for reflection.

### Individual Biographies

In considering situated learning and the social structures that inform learning, it is important to recognize that individual biographies influence the community. Hodkinson and colleagues (2004) emphasize the influence of individual workers' prior knowledge and understanding and their dispositions toward work and learning that contribute to the communities of practice and other organizational cultures where they work. Hodkinson, Sparkes, and Hodkinson (1996) have also documented the importance of prior knowledge and skills for teachers' workplace learning. Cynicism, for example, based on previous ineffective professional development programs, can cause even dedicated teachers to perceive *any* proposed professional development effort as a prospective intrusion with no real payoff.

Because the dispositions of teachers interact, it is hard to predict whether or not particular

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collaborations will prove successful. Organizational and structural factors, of course, have a bearing on the relative weight of individual dispositions. For example, because most secondary teachers are organized into departments according to academic discipline and have a deep loyalty to their subject field, their collaborations within academic subject areas may have a greater chance of success. Department members' skills and knowledge have much in common. Further, the meaningfulness of their community rests on the strong social validation accorded disciplinary expertise.

Dispositions related to minority and majority oppositions (for instance, white versus African American, Hispanic, or Asian groups) also need to be considered with respect to learning communities. Hodkinson and colleagues (2004) describe the debilitating effects in one instance of being a non-white teacher in a learning community that was predominantly white. Their case study shows that changes in professional identity can be negative as a result of community norms that stereotype or in other ways constrain individuals from ethnic or racial minorities. Learning at work can damage a person's sense of professional identity if discriminatory practices infect the community (an arguably likely scenario when faculty are ethnically different from one another). Even if individuals from minority groups bring confidence and assurance to the community, the actual operation of the community may entail powerful social forces make those strengths inaccessible to the work of the community. That is, the influence of racism can harbor surprises for the unwary.

McLaughlin (2003) discusses problems of differences in values, noting that even the purpose of teaching is contentious: There is considerable disagreement about educational goals, as noted in the discussion of traditional mathematics instruction versus instruction based on the relatively new mathematics standards. Differences in political beliefs, in beliefs based on ethnic diversity, in religious beliefs, and so on all can produce or influence contrasting educational

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perspectives. These different beliefs about the purpose of education, whether tacit or explicit, generate different and competing educational practices. Basista and colleagues (2001) found that their collaborative program was effective, but that the diverse educational backgrounds and differing grade levels taught by participants sparked difficulties. On the other hand, they note that the same diversity offered an advantage, helping teachers recognize the interdependence of different levels of the curriculum.

Barab, Squire, and Kurt (2002) describe one university field-based community of learners, a cohort of preservice teachers, in which considerable tension arose about the relative importance of readings about theory and practice. Depending on student interest in research—or their lack of interest in it—in some of their seminars, the focus was exclusively on personal experience, uninformed by theory or research; in some there was argument about the value of assigned readings. Among other things, the researchers concluded that students often did not learn to make connections to theory about what constitutes best practice (Barab, Squire, and Kurt, 2002). Not only did individual biography, through disagreements about the value of the research, affect the cohesion of the group in this case, the groups' general acquiescence to a lack of grounding in the literature put the seminars at risk for simply reproducing the status quo.

There is no question that diversity enriches learner communities. Nevertheless, inequities, cynicism, and anti-intellectualism exist, to varying degrees, in every group. Especially in the face of the population's increasing ethnic and racial diversity, as well as its increasing polarization of wealth and of religious belief, professional development needs to be shaped to take into account these problems, which can range from minor irritants to forces that defeat attempts at both personal and professional growth.



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### Technology in Learning Communities

In rural areas, in particular, learning communities that include teachers from more than one school may find it difficult to meet in person. Electronic learning communities are a common response to this difficulty. The relative effectiveness of electronic communities compared to on-site communities is not clear, however. Whether they are more or less effective depends on the purpose and tasks of the community, but it is certain that communicating electronically, rather than face-to-face, generates different relationships. As Howley and Howley (1995) remark in a commentary on rural context, “technologies remake the ways people relate to one another” (p. 128).

Regardless of their relative advantages and disadvantages, Internet-based virtual learning communities are proliferating rapidly. Computer-supported intentional learning environments (CSILE) are a fairly recent application of virtual learning communities in education (Luppicini, 2003). These virtual communities share common interests and personal responsibility for contributing to knowledge-building efforts within the community, just as face-to-face communities do. For example, one such community within a graduate course in education had teachers work independently on readings, then work together electronically as a group on concept mapping (Luppicini, 2003). Luppicini also describes virtual communities that constitute communities of *inquiry*. These communities, he says, are primarily used for problem-based learning endeavors in formal professional preparation and development programs. They apparently focus on highly structured tasks related to higher-education curriculum rather than tasks that arise primarily out of the community members’ daily practice. Such communities could, however, identify and structure problems focused on local issues that may be more meaningful to the community members, particularly for inservice education.

Schlager and Fusco (2003) discuss the potential of technology for supporting and

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strengthening local communities of practice. They report that online sociotechnical support structures and professional development activities can foster healthy cultural norms, membership diversity and growth, distributed leadership, public and private dialogue, and professional networking on a large scale. Their choice of example is Tapped In, a virtual environment designed to support the online activities of a large and diverse community of education professionals. According to Schlager and Fusco, Tapped In can be thought of as a network of practice, as a constellation of practices, or as crossroads of educator communities. Thousands of teachers log in each month for course work and for workshop sessions, meetings, and discussions. They report, however, that such electronic communities as Tapped In appear to remain only tangentially related to the predominant practices of professional development in the community members' own school districts. Schlager and Fusco (2003) believe that a local, systemic online education community of practice provides more equitable access and also helps provide incentives for teachers to participate in both formal and self-organized professional learning activities. They emphasize the importance of the local community of practice's possessing a set of online options that the members can tailor to meet their own learning and collaboration needs.

Cuthbert, Clark, and Linn (2000) identify four major design considerations for creating such online learning communities. They believe that local online learning community technology should

- support the actual practices and daily tasks of the learning community members;
- collect members' experiences and represent experiences in an accessible and equitable manner;
- provide a framework to guide the members' learning process; and
- represent meaningfully the identities of the community members.

### The School Culture

Teachers and students are more likely to succeed in a culture that fosters hard work, commitment to valued ends, attention to problem solving, and focus on learning for all students. The complex relationships among members of learning communities, their activities, and artifacts represent powerful tools of pedagogy (Buysse et al., 2003). According to Buysse and colleagues, these tools have the greatest effect when the learning community is not regarded as confined to one set of meetings or to a particular cohort, but is viewed as enduring over time in a way that makes sense of and creates continuing opportunities for learning. Peterson and Deal (2002) describe school culture as the key to productivity in schools. On the other hand, Langer's (2000) case studies suggest that a critical aspect of school culture is the extent to which teachers create a professional learning community. Hargreaves (1997) noted that successful schools encourage teacher risk-taking in trying new strategies and materials, learning from errors, and sharing good ideas in ways that lead to increased self-efficacy, higher expectations, and improved learning. In successful schools, teachers share in ongoing deliberations with colleagues, and these deliberations appear to help them translate new ideas into practice.

Teacher learning communities need to be an integral part of school life, however. The program format for the Ohio professional development program cosponsored by Wright State University and the Trotwood-Madison and Huber Heights school districts was considered effective, but a major problem seemed to be the length of the summer institute. After trying different lengths for the program's summer institute, the program coordinators found themselves unable to satisfy the participants; some participants found the institute too long, and others found it too short (Basista & Mathews, 2002; Basista et al., 2001). This dissatisfaction points up a basic problem with the institute and workshop models: They represent a block of time that teachers are

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likely to see as an “add on” that does not fit smoothly into either their work or their leisure routines. Learning community approaches have addressed this problem effectively under some circumstances, particularly when they have incorporated elements such as meaningful work, task-oriented leadership, and opportunities for reflection.

An established learning community seems to acquire value as, over time, it contributes to the teachers’ positive view of themselves as professionals. Collective efficacy, as described by Goddard and colleagues (2000), is the school staff’s belief that staff members can work collaboratively to bring about change. This belief typically emerges only over a period of time. The North Carolina Lighthouse Schools Study, for example, found that dialogue regarding instructional norms occurred both formally and informally in the most successful schools. Teachers met regularly in grade-level teams to review student progress and discuss teaching strategies. In formal sessions, teachers and administrators developed stronger procedures for promoting data-directed dialogue regarding school reform. Grade-level planning sessions and school-based staff development featured discussions of students’ progress on a range of assessments of achievement. Teachers assessed their own success based on student learning. Using student-achievement data as a basis for dialogue became part of the school culture.

In the North Carolina study, teachers in one school reported that the curriculum facilitator and media specialist worked together to make data—such as school performance data, grade-level reports, teacher reports, subgroup reports, reports by curriculum goals, and K-2 assessment data—more accessible to teachers,. These collaborative work sessions became a source of energy and support for teachers as they learned to rely on each other as teammates. Teachers reinforced these instructional norms in monthly study groups or in collaborative planning sessions held each week by grade level. Teachers broke into study groups, shared and wrote papers to disperse to the other teachers, and used multiple sources of data to assess progress. They developed a shared

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sense of responsibility for all students' achievement. In circumstances like these, professional development is not a burden; rather, working together is a source of energy and renewal (Goddard et al., 2000). Teacher learning communities can produce a shared repertoire of skills, vocabulary, styles, routines, and sensibilities developed over time. They can share a mutual engagement that binds members together into a cohesive social entity.

### Demonstrated Benefits of Teacher Learning Communities

Formal research on teacher learning communities is limited; more prevalent are evaluation reports on programs that employ a professional learning community approach. The results of both research studies and evaluations, however, suggest that the learning community approach is often effective in improving teachers' content knowledge, pedagogical skills, feelings of collegiality, attitudes toward students, and confidence level as teachers of mathematics. There is less research evidence that the work of teacher learning communities significantly improves student achievement. Formal and informal evaluations of teacher learning communities and other professional learning communities have also identified common problems in the design and implementation such programs.

Among the methods of ascertaining the value and benefits of teachers' learning communities are the familiar Likert-scale questionnaires asking participants whether they regard the experience as worthwhile in terms of various desired outcomes. Such methods are of dubious value, however. On the other hand, researchers have also incorporated assessments designed to measure teachers' gains in content knowledge more directly. Using authentic assessment and other more qualitative methods, researchers of the success of communities of learning have analyzed content tests, copies of teachers' "free writes," audio transcripts of learning community discussions, classroom observations, and sample assessments in order to determine the

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effectiveness of the community design and activities. Assessments have also analyzed participant portfolios to document growth in knowledge and pedagogical skills (Basista et al., 2001). Many studies incorporate several types of assessment. For example, a two-year research study (Hollins, McInyre, DeBose, Hollins, & Towner, 2004) of a teacher learning community in an elementary school in a large urban district examined a self-study approach in changing teachers' "habits of mind" and whether these changes affected student achievement. The study combined qualitative and quantitative methods, including interviews, transcriptions of meetings, recorded field notes and informal conversations to identify themes, and an analysis of student achievement test scores. The outcomes of these evaluation methods in general suggest benefits for teachers' content knowledge, pedagogical knowledge, and professionalism and student-oriented "habits of mind." The evaluation suggested much more limited benefits for their students' achievement. This is not much of a surprise, considering the weak evidence of the association of professional development activities and student achievement (Howley & Howley, 2004).

### Content Knowledge

Basista and colleagues (2001) report evaluation results for the above-mentioned integrated science and mathematics collaborative professional development program offered cooperatively by an Ohio university and two school districts in Ohio. The program they report on consisted of an administrator workshop, an intensive summer institute and, during the following school year, five follow-up seminars and five classroom visits as well as consultative support. Ninety-seven percent of the participants (who were 33 second-grade through high-school teachers) believed their content knowledge had improved. Their posttest scores validated this belief, in that they showed a 61% average gain over pretest scores on a test of science and mathematical skills taught during the summer institute. Eighty-five percent of the teachers

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believed they had gained skills in reasoning, and the same number believed they increased their ability to see connections between science and mathematics. During the next year of the program, Basista and Mathews (2002) found that the participants' content understanding improved, as indicated by a pretest/posttest gain of 69% in integrated physics and mathematics and 47% in mathematical modeling.

### Pedagogical Knowledge

Donleavy (2001) reports that teachers find that sharing what they learn stimulates their thinking and makes their instruction more effective. Basista and colleagues (2001), describing the collaborative Ohio program considered previously, which involved teachers in developing and teaching units and giving feedback to each other, note that as a result of this program, 85% of the teachers believed they improved their skills in using inquiry. A Likert scale self-rating indicated that these teachers also gained in confidence in their ability to use inquiry-based teaching to integrate science and math. The pre-post test questionnaire showed that significantly more teachers felt prepared to use cooperative inquiry or discovery learning, to phrase questions to encourage more open-ended investigations, and to teach heterogeneous groups. Later participants in the program also changed in a positive direction. During the following year, teachers' self-perceptions regarding pedagogical preparation and confidence were evaluated through a qualitative post-institute survey and a Likert scale questionnaire given before and after the summer institute. The Likert scale indicated that participants felt better prepared after the summer institute to implement inquiry learning, phrase questions for open-ended investigations, manage a class of students using hands on manipulatives, use cooperative learning groups, engage students in applying science/math concepts, and use performance based assessment (Basista & Mathews, 2002).

### Professionalism

Hollins and colleagues (2004) found teachers increasingly willing to accept published research as their collaboration in a community continued over time. In their study, a group of African American teachers read about African American children who were not allowed to participate in an enrichment program because of perceived attitudes associated with African American culture. Discussion of this article led the teachers to greater interest in reading about culturally related issues in classroom instruction, and appeared to be a benchmark in the teachers' changed attitude.

A study of a field-based preservice program in which students tended to show disdain for readings of research and theory, however, did not mention such growth. The researchers concluded that if a connection with the literature is desirable in the professional preparation of teachers, it needs to be built into the accountability system, for instance as part of the participant's portfolio (Barab, Barnett, & Kurt, 2002).

Hollins and colleagues (2004) also found that the teacher learning community in a predominantly African American elementary school appeared to make a difference in how teachers viewed their students. The African American Literacy and Culture Research Project, designed to enhance teachers' ability to facilitate literacy acquisition and development for urban African American children, grew out of collaboration between a university and a large urban school district. In an elementary school in a predominantly working-class community, where most of the teachers and the students in the school were African American. At the beginning of the series of meetings, the twelve teachers, ten of them African American, consistently described the children as different from themselves. They seemed to make an effort to disassociate themselves from their students, whose achievement was generally low. During the



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course of their meetings, however, the discussion shifted from defending their own practices to both looking for possible solutions and collaboration to find new approaches to help students succeed. The teachers' conversation shifted from blaming their students' families and home life for the children's lack of success to talking about the students' strengths and focusing on means of improving their achievement.

This structured, locally based, study-group approach to promoting a self-sustaining learning community in an urban California school system succeeded in changing teachers "habits of mind," the way teachers talked and thought about their work and students. Hollins et. al, found that over the course of two years, the study group of twelve teachers reflected on their practice and learned from each other. The group used a structured-dialogue, problem-solving approach that focused on teacher collaboration and within-group directed inquiry as a means of improving literacy acquisition and development among their students. The dialogue is described as a five-step process, which apparently contributed to the success of their efforts. This process

- (1) delineated major challenges to improving students' achievement;
- (2) identified possible approaches for meeting challenges;
- (3) implemented teacher-selected approaches;
- (4) evaluated implementation of the approaches; and
- (5) formulated theory to guide future instructional practices.

### Student Achievement

There is little in the way of solid evidence of the impact of teacher learning communities on students' performance, but there are testimonial and anecdotal reports on improved student achievement as a result of the learning community approach. Reaching a little beyond the anecdotal, Hollins and colleagues (2004) used quantitative data to study a teacher learning

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community's possible effects on student performance, namely the students' reading and language scores on the Stanford Achievement Test, 9<sup>th</sup> edition. They found that after a three-year study group intervention focusing on literacy, elementary school students in the largely African American school improved their reading achievement. Second-graders' achievement at the school went from only 45% of the students' scoring above the 25<sup>th</sup> percentile in 1998 to 64% of them scoring above the 25<sup>th</sup> percentile in 1999, to 73% above the 25<sup>th</sup> percentile in 2000. Third-graders at the school went from 32% above the 25<sup>th</sup> percentile in 1998 to 53 percent in 1999 to 63% in 2000. Although these improvements can hardly be attributed with certainty to the changes wrought by the study-group, they are suggestive of possibilities in light of the fact that these gains were larger than for the school district's other second- and third-grade students.

In Strahan's (2003) study, researchers identified three elementary schools with a history of high performance on statewide achievement tests that also served students who had not traditionally scored well on such measures. In 1997 fewer than half the students scored at or above grade level on achievement tests. Since that time, according to Strahan, dramatic progress has been made, and results of interviews with the participants suggest that professional development learning communities helped. Teachers used data about student achievement to help teachers reflect on their teaching and to plan future instruction.

### Barriers to Creating and Maintaining Professional Development Communities

Reviewing the literature on professional learning communities in education reveals several very durable problems in creating effective communities. These problems relate to the relative lack of funding for professional development, the nature of school leadership, and to the problem of adequate support for making these communities integral elements of the school culture.

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### Lack of Funds

Lewis (1998) finds that it is difficult to change schools' reliance on packaged workshops and one-show visits by experts. Because of a lack of state and local funds for professional development, many school districts rely on federally assisted professional development programs. These programs help, but are not enough to meet the need for professional development.

The National Science Foundation (NSF) funded the State Systemic Initiative (SSI) for the planning and implementation of efforts to improve science and math instruction. Professional development is the largest category of expenditures by the states under this program, accounting for about one-third of SSI money on average. State school systems focus on professional development because of the inadequate preparation of elementary and middle-school teachers in science and math. SSI, however, has been found by researchers not to have much influence on either state policies or local district practices. While Lewis finds the quality offered by SSI programs is high, based on state and national standards and providing continuous support, nevertheless, on average teachers received less than a week more professional development during the school year. Also, many SSI activities are still planned and implemented with little teacher input. One of the most difficult issues for most SSI programs is the question of the problematic, but apparently necessary, tradeoff between working with large numbers of teachers superficially or small numbers intensively.

### The Nature of Leadership

Harris (2003) asserts that the principle of leadership is at the core of building professional learning communities in schools, and that school systems need forms of leadership that support and nourish meaningful collaboration among teachers. An institutionalized follower/leader

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dichotomy hinders growth of community. Harris believes that leadership needs to be redefined if professional learning communities are to flourish, and that leadership compatible with a socially constructive view of learning requires constructing meaning collectively and collaboratively through continuing conversation. Such leadership seeks to reflect on and make sense of work in the light of shared beliefs and new information so that collaboratively created actions can grow out of these new understandings. She calls for participatory leadership, where all teachers are part of a change effort, with some especially experienced or willing teachers assisting other teachers as they shape school improvement efforts and goals. Harris's view includes the premise that leadership is fluid and emergent, and that every person in one way or another can demonstrate leadership. She cites Silns and Mulford's (2002) research showing that student outcomes are more likely to improve where leadership is distributed and teachers are empowered in areas of importance to them.

Accomplishing a more distributed form of school leadership is difficult, of course, because it requires people who are currently in formal leadership positions to relinquish power and control. A new incentive system seems to be needed before much change in the form of leadership will take place. Without a redistribution of incentives and resources, teacher leadership will be an ad hoc activity with little systematic effect (Harris, 2003), and democratically oriented collaborative efforts will continue to struggle even to survive.

Leadership in collaborative professional development programs has not been studied much, but there is some evidence that teachers are sensitive to the status of persons taking on leadership roles, even though they may be primarily facilitative roles. Hollins and colleagues (2004) found teachers more responsive when the principal took a more active role in the study group meetings as opposed to a researcher's (graduate student) carrying out that function. Club Maroon's dean of student services seemed to perform a facilitative role helping the group cohere.

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The facilitative role does not necessarily and, in many cases, probably should not involve an administrator in a traditional, authoritarian leadership role, however (Harris, 2003). Rather, administrators may, given the current nature of leadership, serve to confirm the participants by assuring them through words and actions that they have a high regard for and respect the relevance of the community's work to the well-being of the school and its students (Hollins et al., 2004).

Participation of leaders in teacher learning communities raises the issue of how trusting and receptive community members can be where some of the members have higher status or political power. Lewis, Ketter, and Fabos (2001) report that in the collaborative reading and discussion group in which they participated, the teachers deferred to the researchers as university experts. The researchers note that, though they were trying to be merely participants, they themselves spoke more times and for longer periods than any of the teachers, but that the teacher who was most involved in school leadership spoke more often and at greater length than the other teachers. Interestingly, the university professors said that while teachers looked to them as experts, they also often discounted their opinions as erudite and impractical.

### Inadequate Support from Leadership

Time is a major problem in establishing and implementing teacher learning communities in at least two important ways. As Hollins and colleagues (2004) found, the multiple demands on teachers' time, especially in schools whose status is low in terms of performance on high-stakes tests, make professional development difficult. Moreover, if learning communities are to become part of the school culture, they need time to become established, but establishing a learning community does not ensure its survival. Van Winkelen and Truch's (2004) report from the business world has implications for professional development efforts in education. They discuss

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two cases in which recently established, but thriving, communities of practice were rendered impotent by company decisions made by high-level executives. In one case, a community of practice based on voluntary collaboration was so successful that the management team of that section of the organization believed the program should be expanded to help break down organizational “silos,” but a change of chief executive officers resulted in disbanding the community to reduce overhead. The community of practice at the other company was also at the pilot level, but it, too, was functioning actively and showing much promise. There, the management team of that section sought to establish a mechanism to provide more executive support for the collaborative program, but without hands-on control from the executive center. The executive, though, after listening to success stories about the established community, decided the community of practice approach would be more valuable in other areas of the organization that he believed were of greater strategic importance. The executive called for establishing pilot communities in these areas, too, but would not agree to provide any significant additional resources to the established community or to establishing the other communities. With little in the way of additional resources, and with demands on management for *more* pilot communities, the original community-of-practice activities were so mitigated that their effect was dramatically reduced. According to Van Winkelen and Truch (2004), “In both cases, it seemed little could go wrong”, but inadequate support from leadership undermined these flourishing communities.

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Recognizing the learning community's dependence on benevolent leadership, Van Winkelen and Truch (2004) make recommendations to designers and implementers of communities of practice. Though these are most relevant to the business world, they have a bearing on teacher learning communities with professional development goals as well. Learning community designers should:

- concentrate first on those areas that will quickly make the most difference;
- build on existing organizational networks that are already recognized as valuable;
- find the organization's stability points (in a large school, this might be the academic departments, such as the math department) and stay close to those points in investing time, energy, and other resources;
- design communities that are compatible with the predominant paradigm of the organization, such as the need for process, structure, and flexibility;
- make it easy for emerging learning communities to receive recognition when they make a difference;
- identify or create the basic processes and technological or other tools for communities to adopt and use themselves;
- be resilient—what the community can actually accomplish may be different from the original goals for the community.

## Conclusion

It is heartening that despite the lack of resources, the majority of rural teachers still seem to enjoy teaching. Compared with their urban and suburban peers, rural teachers have lower salaries than other teachers of comparable experience and are less likely to have health, dental, or

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life insurance, to travel during summer vacation, to enroll in university courses, or even to enjoy a school lunch without performing job duties (NEA, 1999). Yet, NEA survey data show that 67% of their rural teacher members—as compared to 56% of urban teachers and 63% of suburban teachers—would become teachers if they were starting a career again. These teachers apparently care about their jobs and would be likely to participate in professional development that would help them to make their instructional efforts more effective, if such development were not overly burdensome in terms of time, money, or energy.

The instructional efforts of rural math teachers are apparently at least as effective as those of other teachers. Research on mathematics education in rural contexts is limited, but it suggests that overall, students in rural schools achieve as well in math as students in urban and suburban schools (Fan and Chen, 1999). This circumstance is surprising in light of the fact that, in general, students in rural schools do not have access to the instructional resources, such as computers, available to other schools (e.g., Greenberg, 1995). While rural areas and small towns account for 38% of students, they receive only 22% of federal state and local K-12 funding (National Education Association [NEA], 1999).

In many economically disadvantaged rural areas, such those in Appalachia, however, students' achievement does reflect their relative lack of access to resources. According to the 1996 National Assessment of Educational Progress (NAEP) Mathematics Assessment, eighth grade students in three Appalachian states—Kentucky, West Virginia, and Tennessee—scored below the national average, with Kentucky students scoring four points below, West Virginia students scoring six points below, and Tennessee students eight points below (Howley, 2001).

While the mathematics achievement of all students has shown improvement over the last two decades, the mathematics achievement of students from low-income families has not. Students from low-income families are twice as likely as their peers from higher income families



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to score below even the “basic” level in mathematics on the NAEP (Steen, 2003). Math teachers in rural areas with high poverty rates may have to make special efforts to improve their students’ achievement, but their record of commitment perhaps suggests their willingness to do so.

The critical issue is whether or not their commitment is matched by the commitment of the varied federal, state, and local institutions that influence school funding. As Williams (2003, p. 68) says in regard to low student achievement in rural schools in communities with high poverty rates, mandating adequate yearly progress and calling attention to gaps in achievement “are unjust practices if they are not accompanied by full disclosure of the persistent inequities in the current system, together with practical and adequately financed efforts to alleviate them.”

As Howley and Howley (1995) suggest, rural educators are justifiably skeptical of any one “best system” of schooling. Organizing rural teacher learning communities, therefore, may present unique problems, as well as unique opportunities, beyond those reported in the research literature on situated learning and professional development communities (see Howley & Howley, 2004, for further discussion).

On one hand, rural teachers, who are often aware of the centuries’ long urban exploitation of and disdain for rural people and their mores, may be more likely to adhere to traditional methods of mathematics instruction for a number of reasons, including awareness of and sensitivity to the elitist nature of groups that so commonly promulgate innovative educational methods. This skepticism serves rural people well in most cases, but not always. Not surprisingly, the learning community literature does not appear to address this issue.

On the other hand, some characteristics associated with rural communities, such as their commitment to their particular place and to the children in that place, may cause them to be unusually receptive to opportunities to improve their schools. While they might resist participation in a teacher learning community that seems artificial in its purposes and processes

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and alien to their school culture, they are often keenly aware of the need for collaboration and cooperation in order to accomplish goals that are important to them.

One of the difficulties in recruiting and retaining teachers in some rural areas is the relative social and professional isolation some teachers experience in these areas; this problem may make teacher learning communities a particularly effective means of professional development if other barriers, such as lack of funding, can be overcome. Well-designed teacher learning communities may provide an effective means of creating and maintaining rewarding relationships among teachers and other educators in rural communities. In designing such communities, however, educators should bear in mind that for rural special education teachers, and surely for other rural teachers as well, it is important that local values are reflected in the professional development focus and that professional development support is relevant and realistic in terms of rural schools (Rude & Brewer, 2003).

The research literature on professional development for teachers of mathematics rarely focuses on teacher learning communities in rural schools, but an analysis of the literature suggests that by combining knowledge of the important elements for success—and barriers to success—of teacher learning communities with understanding of the local community, designers of rural teacher learning communities may be able to facilitate changes in mathematics teachers' content and pedagogical skills, their professionalism, and their "habits of mind." Though the research is less conclusive on this point, it also indicates that these changes, in turn, can positively affect the culture of rural schools and the mathematics achievement of students within those schools.

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