

Teachers and Teaching

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In this section I explore two domains I believe to be important for theoretical and applied network research for rural education. First, the study of networks for teaching must establish the conditions and features of educational practice in which the networks get used. Focusing on rural education offers an opportunity to create a research agenda around a specific group of teachers who teach in a particular educational setting.

The second domain is the knowledge of the kinds of network use, within the set conditions and in relation to the issues considered important by users. Once the important factors for rural teachers have been established, researchers have to determine whether or not networks support rural education, or whether new educational issues emerge as a result of network use. The five preceding cases are used to demonstrate the construction of such a research design, and to establish an agenda for future research.

Understanding these two domains is part of a necessary general transition in network research. And it also makes sense to connect current network research with the growing body of studies of situated technology use in the work site (Brown & Duguid, 1990, 1991; Suchman, 1987). To date, most research on educational networks has focused on distribution, acceptance, and the amount and patterns of use (Reil & Levin, 1990; Waugh, Miyake, Levin, & Cohen, 1988). But research on the use of networks for educational purposes faces a greater challenge: To determine more precisely the contributions network use can make to teaching (Newman & Torz, 1990; Ruopp, Gal, Drayton, & Pfister 1993). After all, contribution to teaching is the ultimate test for any technology-based teaching aid.

Similar results of past research on network use also come out of our own study of LabNetwork. Our research, for example, shows that the number of network users decreases as demand for participation in network discussions grows. More teachers "listen" to (i.e., only read) network messages than those who contribute messages. For example, Tom Thompson writes:

I would frequently monitor discussions on the network, contributing where I felt I could and

seeking ideas when I needed to. I wasn't a frequent contributor to the network, but it did rapidly become a valuable source of information.

According to most current network research that judges active network use by the *amount* of mail being sent, monitoring network discussions is often a less valued response. However, monitoring network messages can be an active type of network use that is extremely valuable to participants for their particular purpose. Should we be surprised? We do not think so. But what this example suggests is a revision of network research agenda from focus on patterns of network use *per se*, to examination of *utilization of networks for teaching*. We do not think that the quantity of messages, intensity of use, and so on, are necessarily the appropriate measures of successful networking.

We think that the criteria for successful use of networks must be the *purposeful use* of a telecommunication network by a teacher that contributes to his or her teaching practice and/or professional development. This could be in the form of discourse with other teachers, or access to a database (e.g., for teaching weather patterns, conducting a library search, or resolving a technical problem). It could be one message or many messages. The discreet and unique contributions are important to understand if we are to improve the design and use of networks, and if we are to improve teaching.

Many questions arise when we apply such a criterion: What is the appropriate "purposeful use" of a network? Is one kind of purpose more "purposeful" than another? What network components assist in creating conditions for effective use? How are we to determine a successful "purposeful use" from failed attempts to apply network use for teaching?

We also think that the research design of network use must be altered. As important as the answers to the above questions may be, the *process of seeking them* is important to making the questions relevant to teachers. This places much emphasis on the appropriate research design. The tendency, so far, has been to assume that there is one central authority that controls and deter-

mines what is effective network use and its appropriate application. Most network research questions derive from such a paradigm (Harasim, 1990; Riel, 1990), including the LabNet staff at an earlier stage of our research (Ruopp et al., 1993). We revised our research agenda because, for us, a critical component of teacher change is having a *critical discourse about* the purposefulness of the network in teaching situations. The five teacher cases demonstrate our belief that research must be embedded within critical examination by teachers. We also try to understand how the network contributes to the teaching and professional development of each teacher. After reviewing these teachers' experiences, I will return to these issues.

The Rural-ness of Being Rural

Renewed teaching relies on generating new ideas, resources, and on opportunities to examine one's teaching. Below, I look at four conditions the case writers mentioned in relation to their situation of being a rural teacher.

Isolation. All five teachers mention the dimension of isolation. Being in a rural setting, to judge by the cases, appears to create a situation where resources and opportunities for professional reflection are in short supply.

The network has been effective in ameliorating isolation and providing resources. Geriann Walker writes:

Like my students, I also use the LabNetwork to get ideas and feedback. I've obtained many ideas for projects, activities, labs, and demonstrations from teachers on the network. As a new physics teacher with a degree in chemistry but only one college physics course to my name, this type of resource has been invaluable. Last week, I received a lab on friction from a teacher in Texas. Now I can use my computer force probes for something other than dynamics experiments. I also got the idea for my second quarter physics project, the King of the Hill Contest, from a LabNet teacher. . . . Furthermore, it was a LabNet teacher who suggested that I look to local businesses to help fund student project work. (I have been raising about \$400 a year by following this teacher's advice.) And like my students, who feel that their work is validated when they are able to share it on the network, I feel validated when I can share my ideas with others who support the work I do.

As Geriann's experience shows, the network offers her an opportunity to be in touch with teachers who provide her with resources and a way to test her ideas. Similarly, Tom writes:

Personally, I have found telecommunication to be extremely valuable. Each day when I go online, it is like being in a room full of very talented teachers who are sharing all these wonderful ideas. The isolation that is common in a rural school is suddenly gone. The resources often missing in a small school are at my fingertips. Taking this one step further, the teacher at Willamina High School and I plan to use telecommunication to link with other teachers and develop a project-based chemistry class. It sure keeps me going.

It is easy to suggest that this is the central purpose of a science department. Interestingly, for a number of reasons, this is not the case: In rural schools, a teacher often is the whole department. Consider Geriann's typical situation:

LabNet's potential for overcoming the boundaries of place is especially important for rural teachers. I am the only physics teacher in my district, the only chemistry teacher in my district, and the only teacher in my department who is using a project approach to teaching science. In other words, I am isolated. I'm physically isolated from other teachers in my subject area and other teachers who share my commitment to PESL. LabNet lessens this isolation.

Resistance to change. When it comes to applying change, resistance to it is often stronger from *within* one's workplace. Affiliation with other teachers who are interested in introducing similar change can be helpful. As Geriann mentioned:

The support that I get from teachers on the LabNetwork, teachers who share my enthusiasm for PESL, is different from the support that I get from colleagues in my department. While my colleagues do like to share ideas, they have seemed unwilling or unable to adopt PESL methods or to make use of the LabNetwork.

Limited resources. Districts have limited resources to offer new alternatives for the usual off-site teacher

workshops that mean long-distance commuting and rather expensive hosting. In Sandra Rhoades' case in rural Georgia, she describes the local conditions and the implications for limited teacher training:

All of the participants in the workshop were from rural, underserved schools. They tended to be isolated; for most, this was the first workshop attended. In fact, few workshops had been offered in the vicinity during their entire teaching careers. The counties do not have science supervisors, so these teachers were ideal candidates for telecommunication. On-line discussions and exchanges of ideas, new methods and laboratory experiences—both would have greatly relieved the isolation they experience.

Professional development. Rural districts specifically face a problem of continuing professional development. Clearly, single workshops have a limited effect on teaching. Norm Anderson reflects on his need for continuing contact:

Were it not for the ability to communicate with my colleagues on the network, I know that much of the work accomplished during the summer workshop would have been lost.

Under these circumstances, let's now examine network use for teaching.

Network Use as an Expansion of the Concept of Teaching

The network expands the teachers' concept of teaching practice beyond their physical boundaries. While it is almost a cliché to suggest that networks do that, we turn the argument around. That teachers *choose* to use networks for this purpose suggests their *need* to expand their teaching—and the responsiveness of LabNetwork, and other networks, to these needs.

The expansion of teaching is experienced by the five teachers in a number of ways. With the exception of Sandra, who experienced failure in using PSINet with other rural teachers, all teachers found the network responsive to the needs mentioned above. A second dimension—more subtle, yet critical for effective teaching—is the importance of belonging to an electronically networked community of practice.

Community of Practice

What is meant by "community of practice"? The fabric of such a community is woven from the actions and interactions of individuals. In a community of teaching, participants employ similar work practices, develop a similar teaching approach, use similar tools for that purpose, and communicate with people who share their interests.¹

We believe that, in order for teachers to grow and change in the ways we have discussed, a supportive community of practice is essential. Dialogue with fellow professionals helps teachers reflect on their experience, understand it, and change it. Dialogue also allows new ideas and new understandings to spread. When an intervention like LabNet ends, the community can sustain the process of change and help teachers continue to learn on their own. Thus, dialogue within a community of practice is critical for the gradual, long-term movement that we believe characterizes change in both individual perspectives and nationwide educational practices.

A critical dimension embedded in the notion of a professional community of practice is the affiliation with teachers who, although concerned with similar issues, express *multiple voices*. Each teacher thoughtfully considers the information, using it at his or her discretion. But the other part of this affiliation is to come back to the community and report how the application of knowledge worked. This is where the contributor and the recipients of the telecommunication message learn.

Gerriann's message below suggests the potential of networks to provide space for such professional discourse:

For us, using the network means continuing to work with people whom we trust, people with whom one easily can take risks. The familiarity that we share has allowed us to expose our areas of expertise as well as our weaknesses. There is a niche for everyone: the "techies," the philosophers, the pedagogues, and the pragmatists.

There are a number of limitations to building and sustaining such a community of practice. As Norm, Gerriann, and Tom mentioned, the potential of networks to support reflective practice depends on the

¹Relevant studies that use this term have been conducted by Lave and Wenger (1991), Wenger (1990), Star and Griesemer (1989), and Latour (1987). Riel (1987, 1990) and Levin, Riel, Miyake, and Cohen (1987) discussed the idea of electronic apprenticeship as part of a community of practice; Bruce and Rubin (1992) discussed teacher collaborative work in Project Quill. For a developmental perspective on apprenticeship and cognitive development in a community of practice, see Lave (1988), Rogoff (1990), and Resnick, Levine, and Teasley (1991).

intimate knowledge of one another and the building of trust. Norm writes what is echoed by all, the importance of knowing one another:

The main reason for staying with LabNet is the fact that I have personal contact with the leadership involved with the network, along with the participants, many of whom I know on a personal basis.

How do we build trust across geographic distances—trust of diverse cultures, school systems, and educational approaches? Do we face the paradox that optimal network use for professional development may depend on teachers first meeting face-to-face, then employing networks to continue the discourse?

Another type of community of practice can be found in the local community. In his anecdote below, Tom illustrates the benefit that network use can have for multiple parties:

A parent once asked me for ideas to include as competitions in the local science fair. Rather than dig through my files, I used telecommunication. With a brief message on LabNet, I was able to provide this parent with a list of some very good ideas sent by other LabNet participants.

By expansion of teaching, we suggest that network use can enhance our conception of teaching and teacher development. For example, can we imagine a school day where students and teachers have one hour to respond to mail pertaining to their educational development—for teachers, to communicate with other teachers or administrators or parents; for students, to communicate with peers and other teachers regarding academic work.

What are network features that make on-line communication unattractive? Sandra tells us about her discouragement with PSINet: It is only available for MS-DOS machines and has few accessible telephone lines. Sandra also raises two important issues that can discourage reflective dialogue. First, a network used by "science supervisors" is limited in its capacity to reach out to teachers. Teachers want to talk with other teachers. Second, most of the communication on PSINet comprised private messages. This misses a dimension we view as most critical to teacher development: making teaching practice public on a forum so teachers can learn from one another.

Forming a group, a community of teachers interested in supporting one another's work, is still in its

early stages of development. Geriann mentions shortcomings that restricted (or at least made her more guarded about) her use of the network to share her teaching:

Why is it that very few LabNet teachers have engaged in collaborative projects where students share information over the network? Why is it that new network users often fade away and do not become permanent members of the LabNet community?

Elsewhere she writes:

If I'm honest, I must admit that, like my colleagues, I have also failed to take full advantage of the opportunities that LabNet presents. I really could use the network more. I could log on more frequently, and I could make more of an effort to respond to other peoples' messages and questions. (Although I do quite a bit of this type of thing already, messages often sit on my desk a week or two before I manage to send a reply).

We could return to the question of creating an appropriate work environment that takes into account the time and resources for teachers to communicate with peers (e.g., modem, computer, funding). But this will not respond to Geriann's concerns about the quality, persistence, and comfort in sharing educational discourse as part of professional practice. As one television celebrity recently said to her colleagues: "I would like to thank all my peers—who peer at me!" Being a peer is also creating a condition to be peered at, which can be a rather discomfoting thought. The key seems to be in creating a community of practice that holds a common view about the effective and purposeful use of the network—a community that not only utilizes the network, but also collaboratively examines its effectiveness in serving the community's needs.

Future Research on Network Use by Rural Teachers

So far, little is known about a network's usefulness for responding to issues surrounding the "rural-ness of rural teachers." The perspective of such research must first seek to understand the setting of rural teaching. Network use by rural teachers has to do with their *incorporation* of the tool into their work setting. This goes beyond the four aspects mentioned above. We need to understand more about the specific teaching conditions of rural educators.

For example, consider science teaching in rural schools. An informal review of rural and small town LabNet teachers suggests that they are more capable than their urban partners for introducing change in support of project-enhanced science learning. They are also more interdisciplinary: Consider Geriann, who teaches chemistry, physics, and earth science. Also, rural teachers have more flexibility in structuring the teaching experience, such as teaching outdoors. In science studies, where the outdoors is the playground for experimentation, it would seem that rural teachers have an edge on their urban and suburban colleagues.

At times, project science requires geographic distances. Here, too, rural teachers can be contributors. For example, the Eratosthanese exercise (presented earlier) required schools from various latitudes. The study of weather patterns and ecological diversity are two other areas where rural schools could provide unique settings. Equipped with telecommunication, rural teachers could share their findings with others. An example of this work is the KEMNET (Kansas Environment Monitoring Network) started by two rural teachers, who have students collect ecological data by use of various monitoring devices. This information is then accessed by the various schools. Again consider Geriann, whose student gathered samples from diverse sites, and Jack's science project with Alaskan students who were far apart.

Subsequent research on network use by rural teachers, then, should explore the purposeful use of the network in the specific rural context. Some research questions to consider: What are the unique features of rural teaching, and how do telecommunication networks best apply to those features? What are the specific needs of telecommunication-linked rural teachers' community of practice? (What can sustain or obstruct its functioning?) What aspects of a rural teachers' community of practice could benefit urban and suburban teachers?

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