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Science-Related Telecommunication

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Foreward

I teach physics at Cedar Falls High School in Cedar Falls, Iowa. The enrollment in grades 10-12 is about 1200 students with less than 10% classified as minorities. There are about 400 high schools in Iowa, the majority enrolling between 300-500 students.

Cedar Falls, located in northeast Iowa, is set in a rural area where one need only drive a few miles to encounter the rolling hills and plains covered with sprawling fields of corn and soybeans.

About six years ago, I had the opportunity to attend a NSF summer institute to learn about microcomputer-based laboratories (MBLs). (An MBL is a microcomputer equipped with one of a number of sensing probes for collecting the data of various physical phenomena in real time, and special software for recording and displaying the results.) I was interested in using the MBL in my laboratory because I had previously purchased a kit with components to the game port of a computer.

First Telecommunication Experiences

This particular summer workshop focused on a number of electronic projects for use in physics, chemistry, and biology. Most of the projects were prototypes and not all worked exactly as planned. Time did not permit refinement during the workshop, and many details were left to be worked on when we returned home. When the workshop ended, fortunately, the workshop directors had the foresight to provide for communication among participants via a telecommunication network through the University of Northern Iowa's mainframe computer. Now, in addition to the tremendous amount of work on our MBL projects, we were spending our late afternoons and evenings learning the basics of telecommunication. We were also faced with limited time on the computers for telecommunication, having to compete with regularly enrolled students on campus. Nonetheless, everyone in the workshop learned to log on to the network and send and receive messages.

Prior to the workshop, my school district committed a dedicated phone line for my use in a room adjacent to my classroom. They also purchased a modem for the one computer I had in my classroom. I still had to find a telecommunication program. Fortunately, my high school had the necessary software and our technician instructed me in its use. Without this help, I doubt very much if I would have ever attempted to log on by myself.

Because there was a great deal of enthusiasm for what we had done over the summer, it wasn't long before messages were coming across the network and many of us were beginning to use the projects for demonstrations in the classroom. Almost immediately, questions began to appear with concerns over the failure of some of the projects to perform as intended. But there were immediate answers from colleagues on the network. It may have been as simple as an incorrect value of a resistor or a component that had failed due to incorrect wiring. It was reassuring to have the expertise of all of the people on the network, along with the assistance of the workshop directors.

I remember one particular incident where a slotted interrupter had failed. (The slotted interrupter is an infrared emitter-detector pair encased in plastic with a narrow slot between them. Most photogates employ this type of system.) I thought that something was wrong with the wiring diagram but soon learned that the interrupter had failed because of too small a resistance used in the original circuit. Below is the acutal message I sent over the network:

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I've been having trouble with the slotted
interrupters. They worked fine at first, but
now they don't. I found out the detector side
still works, but the emitter doesn't. Has
anyone else had trouble with them? Norm
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I soon received a response:

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It may be that the emitter resistor (330
ohms) is not big enough, and the emitter
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burns out after a while; if you haven't used
them yet, you may want to use a slightly
bigger resistor here, say a 470 ohm. Steve
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Then the following message immediately appeared:

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From director: subject-slotted inter-
rupters. I suggest we all use 470 ohm.
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These were typical problems resolved because of the resourcefulness of the directors of the institute in providing the network as a fast and effective way of dealing with these types of issues. The network was only available during the subsequent school year, but without question it was responsible for the success of much of the work I did with my students. One device suggested over the network that I personally found very useful was a 10,000 ohm 10-turn potentiometer. Its resistance is very linear and the tolerance rated at 5%. They are fairly expensive as resistors go, but about one tenth the cost of a sonic motion detector. Many experiments in science require one, and the 10k 10-turn potentiometer became very useful for measuring velocity, acceleration, and simple harmonic motion, as well as measuring volume in titration experiments in chemistry.

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. However, I should point out that only about one fourth of the workshop participants were active on the network.

Other Telecommunication Experiences

In 1989, I attended two summer workshops, one in chemistry and the other in physics. Both included telecommunication networks. I used the chemistry network two or three times. The other—the LabNetwork—I am still using. 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. And the LabNet workshop provided a list of user names of all participants on the network; the one in chemistry did not. The LabNet workshop also enhanced the work that I had done previously with MBLs and telecommunication.

Some interesting developments, using computers which were unfamiliar to me, had been introduced by LabNet along with a new telecommunication network. The projects that we worked on were consistent with the direction I wanted to go in the classroom: to have a physics classroom equipped with a set of computers where the students will be doing their laboratory experiments and projects using the computer as a tool to give them immediate feedback that will enhance their learning. It also provided the opportunity to communicate via a telecommunication network. This was a big plus because it gave the participants the ability to exchange ideas and information on the network after the workshop was completed.

Students and Other Teachers on the Network

Students also were able to use the LabNetwork. From my view, this wasn't very successful because so many of my students are involved in other activities that take up most of their out-of-class time. This change has been very noticeable when we changed from a six- to seven-period day and required the students to take an additional class. Not only did it shorten the class periods, this change also meant more time had to be spent outside of class for homework.

I have not been able to get other teachers in my school system actively engaged in telecommunication. I believe the biggest problem is *not* knowing how to use the network. Even now, I do not use the networks as much as I would if I were more familiar with them. We need to organize workshops that focus on how to use telecommunication. This would have to involve the various computers: IBM, Macintosh, and Apple. Another problem is funding: Teachers are not going to spend money from their budget simply to be on a network they really don't know how to use.

I know only a few teachers in Iowa who are active participants on a telecommunication network. Many teachers teach in areas where they have little training. Biology-trained teachers are teaching chemistry and physics. They are reluctant to become a part of a system because of their lack of training in computers. We need at least a week-long workshop where one can explore the capabilities of networking. Until that happens, we will not reach those who have a real need for exchanging information.

A Reflection

During the past several years, a small group of science teachers have formed an alliance that meets three to four times a year at the University of Northern Iowa. Several other teachers indicated they would like to attend but could not because of distance or other commitments. Many nonetheless expressed the desire to be informed of what transpired at our meetings. A telecommunication network certainly would be a major step in helping them fulfill their wish of becoming actively involved with our science alliance.

It is difficult to put into words how much I have personally benefited from my use of telecommunication networks. I, like many other teachers, began my teaching career in a much smaller school system far removed from any university and tucked away in a corner of a state where one rarely had the opportunity to associate with other teachers outside our own immediate area. We need to reach out to those teachers in the smaller communities. One way is through science alliance groups, but a more effective way would be by having a localized, statewide network, and the capability to interconnect with a national telecommunication network.

Postscript: As I write this, information from our state science supervisor came across my desk. Indications are that there will be a statewide telecommunication network with the capability to connect to a national network.