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Distance Learning Evaluation: Final Report 1994-1995 Dutchess County, New York

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Executive Summary

Dutchess County schools implemented a distance learning (DL) program beginning in the fall of 1992. The project, called Infinet 2000, was organized by the Dutchess County Board of Cooperative Educational Services (BOCES) and has initially included at least one high school in twelve of the thirteen school districts, including the BOCES Education and Training Academy (BETA) which serves students county-wide. These school districts contracted with NYNEX to provide the technological backbone, classroom technologies, and technical support for the project. Each participating school has one distance learning classroom, which connects them to a network providing two-way video and audio interaction with the other schools. A number of classes have been conducted over the network in each semester of its operation, involving a variety of teachers and students. The Center for Children and Technology of the Education Development Center and Access to Learning conducted research and an evaluation of the distance learning project in Dutchess County. During the 1993-94 school year, we created and tested measurement instruments and collected background data about the project. Full data collection took place throughout the 1994-95 school year. Our findings from these data are summarized in this report. Detailed information about each of the instruments and measurement tools is available in the Appendix.

We summarize here the findings of the studies:

1. Distance learning was seen as an important innovation by administrators, teachers and students alike. Its purpose was seen by administrators and teachers primarily to be expanding the content available to students throughout the county (e.g. oceanography), and replacing some of the courses that have been lost because of budget cuts. For example, smaller schools were unable to offer some Advanced Placement or advanced language courses without distance learning. Many were also interested in expanding the social world of their students, expressing concern about the geographical isolation of students. They envisioned distance learning as a means for students to learn about and establish relationships with teachers and students outside of their immediate geographical region.

   Most administrators and teachers also consider distance learning to be an important part of the future of education, as do a number of students. Many teachers are also interested in distance learning as a way to expand their professional expertise.

2. The distance learning project has been successful overall in relation to the central goals of administrators and teachers: a range of classes has been conducted, adding new course content and restoring some courses that had been eliminated. Basic logistics have been worked out, although persistent problems of scheduling across schools and planning remain a challenge. The need for continuing resolution, attention, and coordination at a system-wide level somewhat contradicts a current trend in education to devolve decision making to individual schools. A continuing commitment to partnership across institutions is needed if DL is to succeed within the public education system. Even more commitment is needed if outside institutions are involved (e.g. colleges, museums, cultural institutions and so forth). The partnership must patiently and flexibly resolve conflicting institutional cultural issues, including scheduling, performance expectations, supervision of teachers, grading and credit.

3. The technology was remarkably free of problems. Administrators, teachers and students all reported that the technology was very reliable. This was confirmed by our systematic classroom observations. The few problems that did occur usually involved audio issues, and were quickly remedied. When asked about desired improvements, in addition to sound, teachers and students also requested improvements in visual acuity (e.g. larger, sharper monitors). This may be related to their desire for improved relationships across sites (see #7 below). The document camera was overwhelmingly the most frequently used technology in the room; teachers want more training to better incorporate the other media and communications technologies. Many students want more responsibility for operating the various technologies.

4. The pedagogy in the distance learning classes was not notably different from that of traditional high school classes. This was reported by teachers and students and confirmed by observational analyses. Classes were dominated by teachers' lectures or exposition, and exercises and assignments were similar to those in traditional classes. The distance learning implementation was therefore not being used overall to explore or change the nature of teaching or pedagogy. Relatively few students or teachers thought that the classes were too lecture-oriented, and few wanted notable pedagogical changes such as longer class periods, or more off-camera discussions. The biggest pedagogical concern was about the lack of science labs in distance learning classes.

5. Students' achievement in distance learning classes was not substantially better or worse overall when students' numerical grades in each DL class were compared with each student's cumulative average, or when compared to those of students in a traditional class. In some classes students did notably better, in some worse, and in some their performance was comparable to their average performance. There was no overall trend toward better or worse performance across DL classes when examined for the effect of the technology alone. Likewise, students' performances in Advanced Placement DL classes were comparable to state and national norms for three classes. Students' AP scores were substantially better for one course, comparable for a second, and substantially worse for a third. For the three classes where there was sufficient data, we examined student attendance compared to overall school attendance. Attendance was better for two of the classes, and no different for the third.

6. We were interested in how DL classes compare with traditional classes in terms of amount and type of interaction. Systematic observational analyses from a larger number of classes indicate that participation by both teachers and students (talking, lecturing, asking and answering questions) is very similar for DL and traditional classes, with the exception that there is a trend toward shorter turns for students in DL compared with non-DL classes. Variations in the frequency and duration of classroom interactions was due more to the type of course (e.g. foreign language, biology), and the particular teacher, than to the technology by itself. Very little off-task activity was observed in any of the classes.

   However, a particular striking finding from the interaction analysis is how little students actively participate in either the DL or regular classes.

7. We discovered that in DL classes, in-class interaction is only a part of the overall category of relationship, which is very important to both teachers and students. Expansion of the social world of students was a prominent goal for the project. Adults and students were not notably concerned about the character of in-class interaction; in DL classes, it reflected what they were used to in school. How-

ever, they were concerned about the difficulties of establishing real personal relationships, and feeling like "one class". It appears that relationship gets established in part by the things that go on outside of class as much as by those in class — encountering each other in the halls and lunch room, informal exchanges in the borders around class periods, being in each others' physical company. Many of the suggested improvements in DL by both teachers and students concern the establishment of relationships across distances.

8. For the most part, teachers volunteer for DL classes, within the constraints of the course needs defined by the project. Teachers are given basic training on the system, but they both want and need more advanced professional development and on-going support.

9. Students choose to participate in DL primarily because they want to take the subject that is offered. Relatively few were recruited by teachers or guidance counselors. There is an overall perception that students tend to be advanced, motivated students because of the nature of courses offered. Likewise, teachers tend to believe that self-discipline and focus are needed to do well in DL. Administrators, differing somewhat from teachers, tend to think that DL is also good for special needs students, allowing them to be included in classes with "regular" students that they ordinarily could not take. The inclusion of special needs students in a few classes had mixed results. Class requirements were different from what they were used to (pace, lack of personal tailoring of content); some students responded well, although there was a high drop-out rate of the special needs students from the observed classes.

Summary of Recommendations

It takes a long time to develop, implement, refine and stabilize an innovation in education. Research over the last decade suggests that 3 to 5 years is generally required for substantial technology-enhanced innovation. It is also essential to continue to monitor and refine the implementation as both the technology, and the education goals and context change. At this point, distance learning in Dutchess County is still young.

Based on the research, we recommend that the following issues be considered as the project is refined. They are discussed at greater length at the end of the report:

1. Strengthen the system-wide partnerships needed for the project to be sustained in the long term, paying special attention to the problems that appear to be recurring. Review of project structure is likely needed as it moves from implementation to stabilization.

2. Issues of establishing relationships across distances are of primary concern to teachers and students. These need to be addressed, likely through a combination of strategies for getting classes together physically on occasion, and by experiments with the technology.

3. Encourage experiments in innovative format and pedagogy, especially those linked to other desired changes in teaching and learning (e.g. portfolio assessment), and to things the technology does well.

4. Consider carefully the evidence of the low level of student interaction in the classes.

5. Enhance professional development for distance learning, going beyond the basics of operation to more advanced support for instructional and curriculum strategies, integration of the supplementary technologies, and including experiments in innovative pedagogy.

6. The technology functioned very well, but consider refinements to the visual components of the system, especially those that may strengthen perceptions of "relationship". Consider greater roles for students in the operation of the classes and the network.

7. Consider strategies for broadening student participation, including the kinds of courses offered and the adjustments that may be needed to help them to succeed.

Introduction

In Dutchess County, the distance learning network is intended to, "...promote positive change in education" by enriching,"...the learning environment for both students and teachers and help accommodate a full range of student needs and abilities." Our examination of the introduction and impact of distance learning into the schools of this Hudson Valley region concentrates on the ways administrators, teachers, and students view this new approach to teaching and learning, their views of how a full range of student needs and abilities are accommodated in the distance learning classes, the characteristics of DL classes compared with traditional schooling in terms of design and interaction, and measures of student attendance and achievement. The views of various participants often overlap. But at times, we will offer distinct interpretations from the perspectives of different participants; such is to be expected in the evaluation of an innovation, especially a phenomenon as complex as a new distance learning system.

What's new? In 1994, only 6% of U.S. public schools reported having two-way video with two-way audio; an additional 10% reported having one-way video with two-way audio capacity. Either of these two telecommunications configurations would be considered new or different to most schools throughout the country during the last five years. They are certainly new to the schools of Dutchess County. "Newness" and "difference" are defining characteristics of both "change" and "innovation." But, are they enough? We have cast our study of the Dutchess County DL initiative in the longer context of current discussions of change in schools and technology.

Despite the national press coverage, educational rhetoric, and political hoopla, change — revolutionary, radical, or dramatic change — is very seldom the outcome of the introduction of new policy, new technology, or new instructional practice to schools. We should be neither astounded by this, nor should we be especially disappointed. History does not record many completely revolutionary changes in governments, religions, philosophies, or schools. Those that are recorded usually come about through traumatic and massive effort, often through great conflict, and sometimes take centuries to be completed. More frequently, especially in schools, we find that our experiences are captured by homey and pungent phrases such as "we'll dance with who brung us," or "we don't want to reinvent the wheel." School administrators and teachers are very cautious about change.

Terry Deal[1] describes his own experience visiting a high school and observing a group of students working at computer terminals:

> 'A revolution in the way we teach,' noted the math chairman. Then my eyes moved to an overhead projector atop a cabinet at the rear of the room. I noticed a television set sitting unused on a nearby table. I vaguely remembered forecasts of similar revolutions in teaching. Many of the prophesies were mine; most materialized about as much as those regarding classroom television and overhead projectors. As my tour continued, I looked for

> other familiar innovations: the language lab, team teaching, open-space classrooms, or school-within-a-school. All of these have been replaced with new forms strange to me. In some ways, the school periphery was different. But the differences seemed superficial. The school was almost the same. What was happening inside the classroom was almost exactly the same.[2]

Across the nation now, school improvement advocates tend to support instruction based on two separate set of beliefs about how we learn and know. Most school practitioners are seldom purely aligned with one or the other of these commitments. The tension between these views are subtly played out in the development and implementation of the Distance Learning instructional strategy of Dutchess County.

First, there are those that see learning as mastery of facts, teaching as basically technical work, and curriculum as a relatively distilled and narrow canon of material. Secondly, there are those that see learning as the gradual construction of meaning through various and diverse experiences. Experience and meaning are inextricably intertwined, and meaning for each individual is shaped and formed by their specific perceptions, interactions, and conceptions. For these "constructivists," teaching and learning are seen as intellectual work, and the curriculum as a diverse and changing course through varied materials. The Dutchess County goal of expanding the content of the curriculum falls in the first category.

Those who plan technology-based school change see both curriculum and management issues. Cassidy and Lane[3] attribute successful adoption of educational technologies to the confluence of three primary concepts: "...equitable and universal access, student construction of knowledge, and facilitative teaching." Linda Roberts of the Office of Educational Technology, U. S. Department of Education, identifies "...planning, adequate budgets, equipment that is widely available to all students and teachers in the classroom, professional development, technical and administrative support, and well produced programming that seamlessly integrates technology into the flow of learning and teaching."[4] We examine the extent to which Roberts' characteristics are found in the Dutchess County Distance Learning project as a measure of the ways that the initiative is built on established principles and as a check of the validity of these principles.

Keeping our collective eyes on the kinds of innovation or change that DL represented for the high schools in Dutchess County, we examined in both breadth and depth how teachers, students and administrators experienced the network, and how this related to their experience of "regular" school. We did independent, systematic and regular observations of a sample of DL classes and a comparison non-DL class to document the nature of interaction and type of pedagogy that took place throughout the school year. Student achievement and attendance data were analyzed with respect to the cumulative performance of each DL participant, and where appropriate, AP scores were compared to statewide and national norms.

The report is divided into five general sections. First, in order to help readers understand how we worked, (1) the methods we used to collect information are briefly described. We then combine our findings and interpretations of the information gathered by all these instruments in two large sections: (2) teaching and the integration of DL into the education system and (3) learning. To explore in greater depth some innovative aspects of the program, (4) a case study of one of the more innovative courses is summarized. We conclude with (5) a set of recommendations that arises from these data. Details of the study are included in an extensive Appendix. Where appropriate, the research instruments themselves are attached. Detailed data analyses by individual instruments are also to be found there.

Methods for Gathering Data

In order to understand and evaluate the DL implementation in Dutchess County, we collected two overall strands of data. All procedures were developed and tested in the pilot phase of the project, the 1993-94 school year. Each instrument and procedure was tested and refined in the pilot phase so that we were assured of its adequacy, reliability and practicality for the full scale 1994-95 study.

First, teacher and student questionnaires, and student achievement and attendance data were collected for *all* DL classes and participants in Dutchess County for the 1994-95 school year. There were 34 such classes. This consisted of. We also conducted in-depth interviews with a group of administrators selected to represent a range of views of the county-wide program.

Second, to develop an in-depth view of the distance learning experience, we complemented these large-scale procedures with in-depth study of a sample of classes. Four DL classes were selected to be representative of the range of offerings; one non-DL class that was taught by one of the focal DL teachers was selected as a comparison class. The teachers in each of these classes were interviewed in-depth, some repeatedly. Samples of students in each class were also interviewed, and we attempted to collect work-portfolios for these sample students throughout the year. Each of these classes was also systematically sampled and observed throughout the year by an observer who electronically recorded the kind and frequency of interactions that occurred in real time in the class, as well as the use of various technologies and other materials. The observer also recorded field notes according to an observational protocol to document the content of each observed class and its pedagogical features. The majority of these focal classes were videotaped.

Participants' Perceptions and Experiences: Interviews and Questionnaires

To understand how the various stakeholders experienced the DL implementation, we conducted interviews with individual administrators, teachers, and students at various points in the 1993-94 school year. This provided us with in-depth data from the different perspectives, and helped us to design questionnaires to be completed by all participants. These data were collected during the pilot phase, and drafts of the

questionnaires were tested and refined to ready them for the 1994-95 study. Thus, refined questionnaires were constructed, tested and distributed to all teachers and students who participated in DL classes during the 1994-95 school year. The teacher questionnaire was quite lengthy and detailed, and it was completed during their free time; the student instrument was shorter and was completed during the class sessions.

We also conducted in-depth interviews with the various participants during the 1994-95 study, based on refined interview protocols that were developed and tested in the pilot phase.

Administrators

We conducted nine qualitative interviews with school administrators in Dutchess County in the spring of 1995. These individuals were selected to represent a range of schools and roles: four school principals, two guidance counselors, one school board president, one district coordinator, and the BETA program administrator. A parent of a DL student was also interviewed.

Teachers

We interviewed three DL teachers in Dutchess county in the spring of 1995 (two of whom had also been interviewed one year earlier), one DL classroom aide, and 2 non-DL teachers. These teachers represent various disciplines — science, language, and business law and civics. These were also the teachers for the classes that constituted our in-depth sample of DL and non-DL classes.

The teacher questionnaire (see appendix A) was distributed to all DL teachers. They were asked to respond to a variety of questions, from basic demographics to more subjective reactions to DL. The latter questions were designed as statements in which teachers were asked to select a score on a scale of 1 to 6. The score of a 1 represents least agreement with the statement, scaling up to a 6 which represents strong agreement with the statement. We coded teachers' responses in three categories: 5 or 6 denotes strong agreement with the statement; 3 or 4 is moderate response; 1 or 2 denotes strong disagreement.

Students

We interviewed 24 students in-depth, either individually or in groups (one of the groups was conducted on-line). Students were selected to represent a range of schools, classes, and levels. Most of the interviews were conducted in June, 1995, but one of the groups, with students from Webutuck and Spackenkill, was conducted in January, 1995. Many of the students had multiple experiences with DL, as both home (the DL site where the teacher is located) and remote students in the classes.

We received 223 completed questionnaires from Dutchess students, which represents 67% of all Dutchess DL students for the year (332 students overall). For some questions, i.e., goals and ideas, advantages, problems and barriers, and improvements, students were asked to rank their responses on a scale of 1 through 6 (1 representing the lowest influential factor to 6 the highest influential factor). We then combined categories in groups of two, (1 and 2, 3 and 4, 5 and 6) to develop a three point scale; not an influence, a moderate influence, and an important influence.

Classroom Observation Procedures

Interaction Analysis

In order to understand how the classes were conducted, the frequency, type and duration of interactions by teachers and students, and the use of and problems with the technologies and other materials, we developed an observation system that allowed us to record these categories of information in real time. *Observer* is a computer-based classroom observation tool for recording these data (see Appendix B). A researcher visited each focal class approximately once every week to two weeks throughout the semester or school year (depending on the length of the class). She used *Observer* to record these key categories of classroom activity throughout the entire period. Home and remote sites were sampled. These data were compiled for each class over time.

Classroom Observations: Field Notes

In order to understand the content and substance of each class, the researcher recorded detailed structured field notes about each class session she observed. This was done immediately following the class session, according to a protocol developed by the research team. The design of the protocol was based on the pilot observational experiences in the previous school year. These field notes were then summarized within categories, and a summary of the content and pedagogical strategy of each class over time was written.

Learning Measures

We collected four kinds of data about students' performances and achievements. First, students' grades for all DL classes and the comparison non-DL class were collected. These were all numerical scores based on the 0 to 100 scale. We also obtained the GPA for each of these students, likewise expressed numerically. This information allowed us to compare each students' performance in DL with their overall high school performance.

Second, several of the DL classes were Advanced Placement courses. We obtained the AP scores of those students who took the corresponding AP exams. We also obtained the average national AP scores for that course, as well as the New York State averages. This allows us to compare performances in these DL Advanced Placement courses with performance norms.

Third, we collected attendance data for each student in these courses throughout the year, and compared these to each individual's overall attendance record in high school.

Finally, for the focal courses we attempted to collect samples of students' work as they progressed through the course. This procedure was problematic for three reasons: student work in most courses consisted of short homework assignments and tests rather than more substantial products; there were logistical barriers to full collection of student work portraits; some of the material consisted of videotaped presentations and there was some concern about confidentiality. These data are therefore incomplete, and only reported illustratively.

Summary of Findings

In examining the data across these various instruments and measures, several prominent themes emerge concerning the experience and consequences of distance learning thus far in Dutchess County. To provide maximum coherence for these complex data, we will discuss findings according to these themes, rather than by individual measure. We were concerned with understanding how the innovation interacted with characteristics of schooling (its integration into the education system overall, and into teaching) and how it affected students and their performances. As noted above, the report of our analyses is thus divided into two overall sections: **Teaching and Integration into the Education System**, and **Learning.**

In considering the results thus far of this implementation, it is important to keep in mind that the program was large and ambitious, involving many individuals and schools. Typically, substantial technology-based innovations require at least three years to stabilize, and to begin to show effects. Some of our previous research suggests that up to five years is needed.[5] We studied the Dutchess County DL innovation in its third year. In addition to assessing results at this point in its development, these data should thus also be considered as *formative*, pointing to particular refinements that would benefit the program as it continues.[6]

Teaching and Integration into the Education System

The summary of our results with respect to the perception, design and impact of DL on the education system and teaching is organized into eight general themes:

- Expectations and experiences of teachers and administrators
- Format and pedagogy in classes
- Relationships and interactions in classes
- Technology
- Selection and recruitment of teachers
- Professional development
- Parents
- Future of DL

Expectations and Experiences of Administrators and Teachers

The project was initiated by the BOCES staff. Districts were recruited for participation, and asked to commit funds for the purchase of connectivity and equipment. Some districts were initially more enthusiastic than others.

At the outset, both administrators and teachers almost universally recollected that they were enthusiastic and hopeful about the potential of distance learning. Three overall kinds of goals were prominent: (1) providing courses or course content for students that would not otherwise be available to them; (2) enriching students' experiences of the broader world through contact with students and teachers in other regions of the county, and potentially other parts of the country (like the United Nations

in New York City) and the world (like schools in France); and, (3) a general appetite for technologies as part of the future of education, and as needed by students for their future lives. Some individuals, especially administrators, were also especially hopeful about enriching the experience of special needs students who go to school in a special facility by allowing them to participate in classes in other high schools.

With respect to the primary goal of expanding content available to students, there were the twin hopes of restoring courses that had been eliminated from some schools because of budget cuts (e.g. certain Advanced Placement courses, advanced language courses), and of initiating new kinds of courses that had not been offered before (e.g. oceanography). Notably, the top goals emphasized maintenance or innovation in course *content* rather than in format or pedagogy. The goals also emphasized fitting the implementation into gaps and windows in the educational system, rather than using the technology to leverage other goals for change.

To anticipate our conclusions, despite challenges and problems during the initial years of implementation, most people remained enthusiastic and committed to the innovation at the conclusion of our research.

Thus, initial and subsequent skepticism notwithstanding, most administrators interviewed reported that there was a shared sense of excitement about distance learning and its potential. *This potential was initially seen primarily in terms of restoring programming that had been eliminated because of budget constraints.* For many, the practical emphasis was initially on restoring courses that had been lost with shrinking funding resources rather than on "enriching the learning environment" of students and teachers. Virtually all respondents referred to this enormously important core benefit, but many also expressed hope that the learning environment would be enhanced in new ways, and that an expanded range of students would be served. They are not just talking of restoring lost classes, but of adding never before taught classes. They were also concerned to offer these classes to students normally excluded from them or who would not have chosen to take these types of classes.

> "It was anticipated that DL at BETA would allow us to offer courses to students that they wouldn't otherwise get and to provide a way to maintain some contact with the students in the districts. It has done everything it was supposed to do."

> "Before DL, we didn't have a German program. Now we have a full time German teacher who has created interest, and there are kids in her class who would never have taken a foreign language."

> "In a rural setting, DL gives kids so much more opportunity. We couldn't offer an oceanography course [on our own] because we wouldn't have the enrollment to support it. DL has been a

> tremendous asset as far as offering the variations in courses."

Most did not, however, believe that DL would be easy to integrate. Substantial coordination efforts would be required to make the planning and scheduling work smoothly. However, the administration in all districts was persuaded that the opportunity was sufficiently promising to justify making an initial investment in the technology.

Administrators identified benefits to students as the "gain" of paramount importance. In addition to enriching the curriculum, other commonly cited benefits to the DL experience were exposure to technology, exposure to other students from different schools, districts, and towns, and the perceived DL classroom imperative to be more attentive, focused and participatory. In sum, within each school community, there was a range of initial reactions to the coming of DL — anticipation, excitement, skepticism, resistance, even though initial interest, especially on the part of the smaller districts, seemed to be driven by the desire to save curriculum for students in a time of shrinking budgets. The larger districts, were by and large, more skeptical at the outset about the benefits of DL for them.

Like the administrators, *teachers'* expectations emphasized the potential of the technology to provide access to courses not otherwise available to students (89% responded that this was an important goal), and to expand students' experiences (70%). In interviews, teachers did not anticipate that DL would compromise educational quality, although some expressed concern about the ability to form and to sustain relationships with students at the remote schools. Teachers also anticipated that the innovation would enable them to advance their own knowledge and professional skills (56%). Both of these goals attribute value to newness or uniqueness — providing learning that was not available before.

Teachers were somewhat less likely than the administrators to indicate that the exposure to other school cultures and students was a top goal (44%), but as noted above they did see DL as a means to expand students experiences generally (70%, see Table 2). Teachers were much less likely than administrators, however, to anticipate that DL would provide substantial benefit to special education students (67% indicating that this was *not* a key goal). Likewise, teachers tended not to view DL as a particularly important vehicle for the development of students' *technology* sophistication (52% reporting that this was *not* a goal). However, they did view the implementation of DL as an important indication that the district was part of the future: 63% perceived that students would be proud of their school because of DL.

Table 1
Teachers' Initial Goals about Distance Learning

	N=	Important goal (%)	Indifferent (%)	Not a goal (%)
Possibility of offering courses to students that would not otherwise be offered	27	89	11	0
Possibility of advancing teachers' own professional knowledge and skills	27	56	30	15

Confirming the general future orientation that DL appears to imply for these teachers, a large majority (81%) strongly agreed that DL is a part of the future in education. And, as noted above, more than half of the teachers (56%) strongly agree that DL can provide an opportunity for teachers to grow professionally. Because we surveyed the teachers late in the process, we can conclude that the Dutchess teachers did not change many of their initial views of DL after gaining some experience in DL classrooms; they continued to view it as an important advantage for students and their own professional development. Perhaps because they realized that some form of technology is required to bridge physical "distance," many of the Dutchess teachers see DL as part of their future in education that spans rural and suburban school districts. They are however, well aware of the issues this raises and of the effort it takes to create personal relationships among participants connected only through DL technology (see below).

Table 2
Teachers' Current Thinking about Distance Learning

	N=	Strongly Agree (%)	Indifferent (%)	Strongly Disagree (%)
DL is part of the future in education	27	81	19	0
DL is primarily a means to expand students' experiences	27	70	22	7
DL provides an opportunity for teachers to grow professionally	27	56	26	19
DL is a way to deal with the financial limitations of today's schools	27	52	33	15
DL is primarily a way to facilitate growth in a school system	26	42	50	8

Partnership Issues

For DL to function smoothly, considerable coordination among schools is required. Since this implementation including 14 schools in each of 13 separate districts, aspects of the "cultures" of these different school systems presented challenges, some anticipated and some not. In interviews, both administrators and teachers noted that considerable effort and good-natured flexibility was needed to succeed at three particularly taxing aspects of this coordination: (1) coordinating **bell schedules** was a chronic headache, since the scheduled periods of the different schools were often not perfectly synchronized. Some schools are, or want to be, experimenting with extended class periods for some subjects. While some teachers learned how to use this to advantage (e.g. using the non-overlapping minutes to focus their attention exclusively on one of the sites), coordinated scheduling began as and remained a barrier to smooth DL functioning; (2) the **planning process** for deciding which DL courses were to be offered, and which schools would participate. Difficulties arose, for instance, in deciding whether courses needed to be "jettisoned" if sufficient numbers of students didn't sign up for them. Achieving course sequence continuity in DL, especially for the various levels of language courses, was also cited as a planning problem; (3) the **unique practical and social circumstances** of individual schools. This included differential scheduling interruptions like snow days, and senior "skip days", as well as more subtle aspects of school culture like rumor mills about classes and teachers. A teacher at a home school may not have sufficient information about the particular "cultural" circumstances in a remote school in any semester to understand and support these students well.

Data from teachers' questionnaires confirmed that scheduling was a key problem; the most frequently cited DL problem was the coordination of bell schedules (67% reporting this to be an important problem, compared with a mere 7% noting it was not a problem).

If schedule coordination is a source of significant difficulty, schools must be motivated to make it work. Different schools may have different assessments of how much they benefit from offering classes on the network. In fact, *most administrators observed that not all schools benefit equally from DL*. In light of the top level goals for DL in this implementation (providing course content not otherwise available), many of the administrators thought that DL provided more benefit to small or isolated schools than it did to larger suburban institutions with more resources. These latter schools have not experienced the same degree of course loss or desire as have the more remote schools in the county. They are more able to afford a broader curriculum and will more likely have sufficient enrollment for a variety of AP and elective courses on their own; smaller schools will not. Thus the enrichment of curriculum that is the primary goal of DL in Dutchess County is not perceived to benefit all schools equally.

> "As a large school, we already offer a rich and varied curriculum. My dilemma is 'what do we have to gain'? Especially in a context of overcrowded buildings, when the DL classroom sits empty, it's like an open wound. I've gone

> to scheduling meetings with a list of things to offer, but either they were already being offered or they were closed out because of the schedule. Many smaller districts jumped on the bandwagon early, and they already have agreements and a full complement of courses in every period. Large school districts don't offer or receive many courses. The big gainers are the small schools which use the network to take AP courses. The scheduling meetings are like cattle calls. Every school goes to the meeting with its own set of priorities, cultures, values, needs, and wants. We have made changes to accommodate the schedule and stay on the system, only to be disappointed or have the kids disappointed."

Administrators from smaller schools also recognize this issue, although they see it from a different perspective. For them, DL offers their schools great opportunities:

> "The bigger schools don't have such a need as we do, because they have the facilities and teachers. [DL allows us to get] electives that those schools already have."

> "Our initial push was on 'what can we get, and what do we have to offer?' with an eye toward AP courses that had been cut because of the budget. In a small high school, we would typically have only 6 or 7 seniors for an AP course, and with that enrollment, we couldn't run the course in-house."

> "DL brings us variation. It lets our students see other cultures, lets our kids talk to people they don't normally talk to. Again, because we're as remote as we are our kids don't get experience outside this area."

One administrator emphasized the importance of regarding a commitment to DL as a partnership between schools and districts. From his point of view, the essence of the "promise" is that by entering the partnership, a school pledges to "deliver bodies."

> "I'm not sure you should jettison the partnership if the numbers don't work out. This is an on-going problem which impacts teachers and students. I think both home and remote sites have a responsibility once they've made a commitment to partnership."

One aspect of examining the "new" in school improvement efforts has to be the examination of how the new will be maintained. Where is it going and what will the new look like when it is no longer so new? Will it simply sit on the shelf or in the back of the room? Are plans in place for continual renewal? In looking to the future, our group of administrators sees scheduling as a continuing challenge — not just in terms of matching different schools' schedules, but also in achieving course sequence continuity (particularly an issue with language courses). One respondent noted the experience of districts pulling out of commitments based on their changing needs.

> "It's hard to predict enrollment and interest with some courses. We may need to have a process to predict and make decisions earlier in the spring to settle our schedules so that districts can plan. This is one of the few negatives I see in the system."

Thus, to work well in a sustained way, schools involved in the DL implementation must recognize a mutual obligation to each other in order for these complex partnerships to work well over time. Ironically, this need for enhanced coordination across a large group of schools comes at a time in education when the trend is for greater autonomy of decision-making by individual schools. An important aspect of future thinking about the support of this innovation is that of seeing network participation as a partnership commitment between schools.

Format and Pedagogy

In interviews, teachers report that they were initially less concerned about the technology itself than they were about the consequences of having a class split into two or more locations. They were concerned about the achievement of remote students in these circumstances. A science teacher worried about how science laboratories could be conducted in DL circumstances, and that AP courses would have less impact because fewer labs were possible. Teachers were also concerned about the reduced time in DL classes to cover content because of the scheduling difficulties.

Most teachers approached their DL and non-DL classes in the same way; none reported or appeared to radically change their teaching style in the context of DL. They adapted the technology to accomplish more or less the same thing they did in regular classes (e.g. using the document camera instead of the blackboard). Some appreciated the ability to tape lectures for absent students, and felt this was an advantage of DL.

With the exception of science labs, most teachers reported that in fact they thought that their DL classes did not differ substantially from regular classes either in content or overall approach. They believed that DL was well suited to language classes because of the talking and interaction that characterized their DL classes. The science teacher adjusted to the limited lab opportunities by doing more demonstrations, and carefully planning for students to do some of the labs at remote sites with aides' support.

During their first semester or year, most teachers reported that DL made teaching harder. More preparation was required, in part because materials had to be

distributed in advance to sites, but also because "top notch" planning and structure was needed for classes to go smoothly. "You can't just wing it." Some teachers reported that DL did not require a change in teaching style, but that it was easy to "fall into" lecturing. However, most teachers felt that discussion-oriented or interactive classes fit DL well. Data from the survey confirmed that the majority of teachers did not think that DL was more lecture-oriented or teacher-centered education (44% did not think this a problem; only 28% believed it to be one). Likewise when asked whether DL led them to perform in lecture mode rather than conduct an interactive class, 56% strongly believe that it did not, compared with 26% who believed that DL did favor lecture. However, more teachers indicated that DL encourages a more *formal* style, and discourages personal contact (37% perceiving this to be a significant problem, with 41% responding it was not).

In interviews, some teachers noted that DL may benefit from slightly smaller class sizes. (County teachers agreed to a student total limit of 21-22, either three sites with seven students per classroom or 2 sites with eleven students per classrooms.) This benefit was confirmed in the survey data. A majority of teachers were concerned about the size of DL classes, believing that DL classes need to be somewhat smaller than regular classes. Class size was ranked as the second highest problem in DL (54% responded that teaching DL classes larger than 15 was too difficult, compared with 21% who did not think so).

Whereas only slightly more than one-third of teachers thought that there should be longer class periods for DL than now exist (37% thought this a significant problem), when asked to rank order problems in order of importance, the need for longer periods was ranked third.[7]

When teachers were asked to identify the problems and barriers in DL from a list, pedagogical problems were ranked well down the list; none was in the top 10 reported problems. The most frequently chosen were that class periods were too short, and that DL limits the use of project-based learning (26% of teachers noted each of these as significant problems). It is also noteworthy that most teachers did not believe it would be an improvement in format to go off camera to have small group discussions (only 21% believed this to be a good idea). Thus, full class periods on camera was the preferred format for most.

An interesting perspective is provided by teachers who were not involved in DL. One reported that she was at first opposed to it. She thought it would prove a cold, depersonalized approach to education, and she was concerned about discipline at remote sites. She also believed DL better suited to language courses than to science because of restrictions on "hands on" activity. Another reported she had a previous negative experience with "auto tutorials", and thought this an extremely impersonal and unsatisfying pedagogical approach. At the time of her initial assessment, this teacher had no experience of DL. But after she had experienced it and talked to participants she changed her attitude. She was surprised at the level of interaction in classes, that students appeared to know each other across locations, and the lack of discipline issues.

Administrators expected teachers to develop an array of strategies for DL, although they were aware that this was not likely to evolve on its own. They reported that teachers would need help to "restructure" their teaching so as not to reinforce passive learning. Left to itself, they thought that DL would not change instructional practice but would reinforce what was already done.

This proved to be the case. Teachers received training and support in the technical aspects of DL, but there were few opportunities — or resources — to provide teachers with the long term sustained support needed to "develop an array of [innovative] strategies." Whereas a few teachers experimented with innovative pedagogy in DL, most worked hard to provide solid instruction to students using familiar, traditional methods that they adapted to DL. Since many of the DL courses were Advanced Placement classes, teachers were restricted in their options for innovation by these structured curricula.

In our observations of the focal DL and non-DL classes, we recorded how often and how much time was spent by teachers and students with texts, either reading or writing. Reading and writing occupied substantial time in only 2 of the DL classes: Advanced Placement Biology and German. In AP Biology students spent a great deal of time writing, in this case taking notes about the teacher's lecture: an average of 17:33 minutes of a class was occupied by student writing. The teacher, by contrast, spent very little time writing (1:21 minutes on average). This heavy emphasis on lecture/notetaking reflects the traditional format for much of the Advanced Placement curriculum and pedagogy. Neither teacher (average of :22 minutes) nor students (average of :27 minutes) spend much time with books.

In the German class, both students (average of 16:43 minutes per class) and teacher (average of 14:22) spent a great deal of time interacting with books, reflecting the structure of the foreign language curriculum. Teacher (average of 3:00 minutes) and students (average of 1:28 minutes) did very little writing.

Strikingly, off-task activity or merely social conversation by students was negligible in all classes: less than 1 minute per period for any class. Field notes from these sessions indicate that some side conversations were occurring for pairs of students, but overall classes were focused on task for the entire period. This supports perceptions of administrators and teachers that discipline problems in DL classes were indeed rare. "Housekeeping" activities were also quite limited (including such things as distributing work, organizing students, and the like), occupying an average of :38 (French) to 2:18 minutes per period (Economics).

These data indicate that time was used judiciously in these DL classes, reflecting teachers' expressed concerns about the compressed time allotted in DL to accomplish a lot of teaching.

Intensive Sample Classes

Below we very briefly summarize the design of the DL and non-DL classes included in our intensive field-study sample.

French (non-DL)

This class used a coordinated print/video/audio curriculum series for language instruction. Whole class instruction with substantial interaction between teacher and students dominated classtime. The text was used with much greater frequency than the other materials. Field notes from the observational data indicate that about half of the students were actively involved in the class; the other half was passive, but able to respond when called on. To keep them involved the teacher began calling on students randomly, but by the last observed class the teacher's enthusiasm for involving all students had waned. Overall, the class "culture" was relaxed and congenial. Students and the teacher were respectful of each other. Occasional side conversations occurred between students, and they were permitted because they were generally not disruptive. The teacher employed fast-paced questioning to increase students' facility with the language and keep them involved. He put effort into keeping the class tone light, using humor and rewards.

German (DL)

The students enrolled in this course had a particular interest in and facility with languages, and many were involved in the study of other foreign languages. The classtime boundaries for this DL course were not sharply delineated because of slippage among bell schedules in the schools. Remote students remained 10 minutes past the end of the home class, into lunch period at the home school. The teacher used this asynchrony to advantage; a small separate slice of time with each class around a common core seemed to work well, allowing focused attention to each group.

A print/video/audio curriculum series was used, as in the French class, but the materials did not arrive until midyear so the teacher developed activities for the students. Similar to French, classes were dominated by whole class instruction and fast-paced interaction, leavened by the teacher's humor. All students in the class were actively involved, reflecting their special interest in and choice of the subject. Cross site interaction increased throughout the year so that by the end, it felt like one class. Students encouraged each other across sites. The teacher used the document camera often, and students also used the document camera to present to each other. The teacher decided to use the wireless microphone so that he could always sit with the students. Visual contact between home and remote participants was thus very good, and technical problems were very rare. In an effort to help students feel like one class, the teacher organized a Christmas party, and a picnic at his home at the end of the year for the students to be together in one place. No management problems were observed or mentioned by the teacher; the remote aides and the teacher coordinated logistics at the beginning of each period.

The students' interest in language, the small class size, and the technology were likely factors that made this class unique and interesting to all.

AP Biology (DL)

This advanced science class included 17 students, primarily seniors, who were motivated and college-bound. The teacher conducted the class primarily as lecture and

based on the prescribed AP curriculum, frequently using the document camera for notes and diagrams. Occasionally, the teacher would switch the camera so that students could see her when she answered a question; more often they viewed her hand and the written material that supported her lecture. Only a small number of students actively participated in the class, and this was most often to ask questions of the teacher. Some of the students at both home and remote sites never talked. Students spent most of their time taking extensive notes and copying diagrams. Remote students rarely saw the students at the home site (teachers rarely switched the the document camera to the full class camera), in fact, primarily when home students presented research articles. There was relatively little student/student interaction across sites. The class was quite labor intensive for students, requiring the absorption of considerable information both in class and through assignments.

One big issue for this DL science class was how to include the curriculum-required labs. The observer was present for two modified labs, done simultaneously by students at home and remote sites with the support of the aide. Other labs were done as demonstrations by the teacher. Limitations on such hands-on features of DL courses remained a topic of concern for teachers.

The atmosphere of the class was informal and industrious; there was occasionally some social exchange among students at the beginning of a class. There were no class management or discipline problems.

The scheduling for this class was difficult. The home site had to adjust the school schedule radically, combining two periods. There were also weather-related scheduling problems. This class experienced some problems with the audio, but there was always an aide at the remote site to assist with the technical functioning. The teacher and the aide coordinated their work at the beginning of each period.

Economics (DL)

This was a one-semester course, a part of the New York State social studies syllabus but not a Regents course and thus schools could be a bit flexible about the curriculum. It is geared toward a college economics course. High school students are supposed to be able to receive college credit for the course through Dutchess Community College. The class originated at the facility that housed the special needs students, and thus integrated these students with those in other high schools.

The class design was predominantly teacher-led discussion. When students were present at the home site, the teacher decided to use the wireless microphone and sit with the students so all participants could always see each other. The document camera was used occasionally for such activities as studying a foreign newspaper. In addition to readings and discussion of theory, students were required to do a semester-long extensive project.

The tone of the class was relaxed and respectful, although there was relatively little student/student discussion. More frequently, the interaction consisted of serial responses to the teacher. Students took notes when the teacher used the document camera, but notetaking was not a dominant activity. Not all students participated in the discussions, but all were attentive and able to respond when called on. It appeared that

the teacher made a point of calling on each student at least once each period. At one point, the aide reported that some students at a remote site were feeling left out because of an audio problem, so the teacher established a procedure of hand-raising and that solved the problem. (The only technical glitch was low audio at a remote site). The aide quite successfully helped remote students with their projects, and with individual prompting about work. Despite considerable effort by the teacher, regular attendance of students at the home site (special education) dropped from 7 to 1 by the end of the semester, while remote attendance remained stable.

Participation in Government (DL)

PIG was a continuation of the Economics sequence. Almost all of the remote students continued in the course; there were 3 new home site students. The teacher organized this class around a mini lecture, followed by student discussion. Frequently, he needed to prompt students to participate. He used the wireless mic, alternating sitting among the students with use of the document camera.

As part of class requirements, students had to create and maintain an "issues portfolio." Each had to select and follow a relevant current policy issue throughout the semester. The class included a project on the criminal justice system, the way that laws are passed and enforced, and their social impact. Interesting events were organized, including a field trip in which some students "shadowed" a judge, a visit by the judge to the class, a visit to the Mayor of Poughkeepsie. The observer felt that the content of the class was compelling, but that the teacher had to expend considerable effort to get students to engage. He had to call on them, frequently prompting them to talk.

Relationships and Interactions

When interpreting observational data, we noticed that an important distinction needed to be made between *relationships* and *interactions.* First, as noted above, one of the key goals, and hopes, of teachers and administrators was that DL would broaden the social worlds and experiences of students. For this to happen, students needed to develop some knowledge and affiliation with each other. Teachers were also concerned that DL might interfere with developing the relationships with students that they felt were fundamental to good teaching, especially with those students at remote sites. Second, we were interested in how the interactions that took place among teachers and students in DL classes might differ from those in traditional classes. We address each of these questions in turn.

Relationships

Much of the worry, reported problems, and effort expended in relation to DL classes fell into this category. There were two key — and strongly felt — reasons for this emphasis. The expansion of students' social worlds and cultural exposure — especially that of rural students — were a key motivation for the project. 65% of teachers agreed that DL provided important cultural exposure for students, compared with 15% who disagreed. And second, a basic belief of many of the teachers was that personal knowledge of and relationships with their students were key ingredients in teaching success.

Interviews with teachers indicated that they felt that DL limited the personal and sustained knowledge and contact with remote students that they enjoyed in their traditional classes. Most teachers believed that it was important for students in a DL class to experience home and remote sites as one class, and found that this took some effort.

> "I miss seeing the kids in hallways and after school and other times. That allows teachers to develop a personal relationship with students. Also, most of my home AP students know me and my style because I've taught them before. They know my expectations, which are high, and they know when I give assignments for the quarter, I expect them to be turned in without reminders. The remote students were learning this about me for the first time."

Some also believed that the quality of in-class time was different in DL, with its greater emphasis on keeping the class together. This was perceived as a potential interference in their relationships with home students as well. The teachers put considerable effort into figuring out how to help students feel like one class. One teacher commented that he thinks of his remote students as if they were...

> "...on the other side of a curtain or something, but very much present. The only time this feeling changes is when there is a disruption that I have no control over, like a transmission problem, or a PA announcement in the other building, or if someone comes to the door of the class that I can't see."

Most believed that it was important that they meet students personally, and that students meet each other.

> "Kids want to meet each other. They ask for it."

Teachers therefore devised strategies to make in-person contact possible. Many traveled to remote sites to teach at least one class each semester. Some teachers visited remote classes when their own schools had days off. Many got students together through joint field trips, social events like dinners, picnics, and parties. Most took advantage of the various technologies to provide more individualized contact, like making themselves available after school for individual students to talk with them over the network, or through telephone contact with students. Administrators likewise indicated that they were aware of, and concerned about, the importance of teachers getting to know remote students.

Teachers also missed the out-of-class designed and serendipitous contact that they have with students in their schools, like seeing them in the halls, talking with them before and after class, and providing out-of-class extra support.

> "The difficulty is not in what goes on in class, but in what goes on outside it."

Some also thought that since remote students were not part of the home school's culture, these students missed out on the passed-along knowledge among students about a teacher's style and expectations that helped students succeed. Remote students were sometimes surprised by lack of the "tacit" knowledge that, for example, a teacher would not tolerate missed deadlines for work.

Survey data confirmed these findings. Seven of the top 10 reported problems with DL related to the nature of relationships (see Appendix C). Over half of the teachers (52%) reported that getting remote students individual help was a substantial problem; only 26% reported that this was not a problem. Other notable problems included: giving equitable attention to all students (41%); perceiving that students are less involved and do less work at remote sites (41%); difficulty forming relationships with remote students (41%).

Conversely, when asked about needed improvements in DL, teachers overwhelmingly chose organized field trips or events so students and teachers could get together in person (80%), and increased personal contact with remote students (70%, compared with only 7% indicating this was not needed) was important. The improvements chosen most often by teachers (80% to 55%) concerned the nature of relationships, in addition to the above: treating all students as if they were yours (73%); teaching a class from one of the remote sites (71%); asking for feedback from students (65%); setting up activities at beginning and end of term so students across sites can get to know each other (59%); never doing busy work during classes (57%); trying to integrate cooperative activities (55%).

Interactions

Most teachers reported that they believed that it was important for classes to be interactive, and that they tried to make their own classes so. This is supported by current research that indicates the importance of interaction for effective learning; learning that is substantially passive is less successful than circumstances in which students can question, conjecture, reason, discuss.

We believed it was important to objectively determine the nature of interaction in DL classes, and to compare DL with non-DL classes on these dimensions. Real-time interactional analysis had not been done before about DL teaching and learning; this implementation thus provided a key opportunity to explore this new territory. What kinds of interaction take place in a variety of DL classes? Does the technology limit this critical aspect of teaching and learning in particular ways?

The amount and kind of interaction that takes place in class is clearly a part of the relationship question discussed above. The exchange between teachers and students

in class contributes to the kind of individual knowledge and relationship it is possible to establish. But the data clearly indicate that the construction of relationships goes beyond the exchange that is possible in class groups. We focus in this section on the in-class component of interaction.

As noted above, we conducted regular real-time observations for one year in 4 different DL classes (AP Biology, German, Participation in Government, Economics) and one non-DL class (French) taught by one of the DL teachers. We recorded the number and duration of questions and discussions/answers by teachers and students. We also recorded field notes about the context of each of the class sessions. Highlights are summarized here; full discussion of these data is available in Appendix E.

With the exception of language classes, DL teachers spent on average two-thirds more class time talking, lecturing, asking questions than the students. Remaining time is accounted for by teachers and/or students writing or reading through using the document camera, texts, worksheets, exams, or notebooks, as well as viewing or listening video and audio tapes.

The language classes, whether or not they were conducted through DL, were different from the all other classes in terms of student verbal interaction. In both foreign language classes, students spent more time in verbal interaction. And, the two language classes were not significantly different from each other on these overall measures. The nature of the subject matter combined with the teacher's efforts to elicit student involvement in both formatsresulted in relatively more verbal interaction by students

While there is some difference in the nature of interaction between the DL and non-DL comparison class (see below), a key finding is that the differences *among* DL classes were more substantial than they were between DL and non-DL classes There was very little participation in verbal interaction by aides or other adults in any of the classes. The subject matter and the teacher appeared to be substantially more influential on the nature of interaction than did the mediation of technology. Thus, teachers and students talked (questioning and telling combined) on average per class period:

Table 3
Teachers and Students: Averages of Combined Questioning and Telling

	Class Periods (Minutes)	Teachers (Minutes)	Students (Minutes)
Biology	35	14:18	4:45
Economics	45	15:39	4:01
Participation in Government	45	20:41	4:03
German	45	18:19	17:25
French (non-DL)	45	16:18	9:33

There were also differences among classes in the number (frequency) of questions or comments by teachers and students, on average per period:

Table 4
Teachers and Students: Number of Questions Asked on Average Per Period

	Teachers (Number)	Students (Number)
Biology	6.1	32
Economics	17.9	10.3
Participation in Government	13.4	7.5
German	22.61	15.11
French (non-DL)	26.13	6.8

It is noteworthy that teacher talk dominated all classes, both in terms of time and frequency of contributions. It is noteworthy how little students contribute verbally in the approximately 35-45 minutes these class periods. The short time frame in typical high school classes for covering substantial material may temper opportunities for students to question or discuss. Complicating the DL class, however, is the more limited core time for instrcution for all sites due to differences between distant school's bell schedule. As observed, almost in each DL class there may be 10 minutes differential between home and remote sites.

In comparing one DL class (German) with a non-DL (French), both classes taught by the same teacher, we equalized the number of classes to 15 and ran significance tests (see Table 5).

Table 5

DL and non-DL Class Comparison and Significance (15 Classes)

TEACHERS

		German (DL)	French (nDL)	Significance
Tell	Time	14:54	9:44	p=.05
	Frequency	19.13	19.20	
Ask	Time	2:42	6:33	
	Frequency	7.20	31.76	
Book	Time	12:38	1:08	p=.01
	Frequency	.67	.13	p=.02

STUDENTS

		German (DL)	French (nDL)	Significance
Tell	Time	10:00	11:28	
	Frequency	56.20	42.67	
Ask	Time	3:26	2:27	
	Frequency	15.0	6.70	p=.003
Write	Time	:55	9:55	p=.02
	Frequency	.07	1.07	p=.000
Book	Time	13:52	1:16	p=.005
	Frequency	.60	.20	p=.05
Tell - Syncronous Talk	Time	3:26	2:27	
	Frequency	6.6	15.6	

Among the signicicant finds are the following:

- There was a significant difference (p=.05) when comparing the length of time teacher talking in the DL class (14:54) to the non-DL class (9:44)
- The teacher used “books” more frequently in DL (.67) and for longer periods (12:38), compared to his non-DL (.13 and 1:08, respectively).
- While not significantly comparable, we noted that the teacher used the document camera on average longer (9:12) but fewer times (3.53), compared to chalk board use in the non-DL (6:26 minutes and 4.6 times, respectively.
- As for individaul students, they significantly (p=.003) asked more questions in DL (15) compared to the non-DL class (6.7). Their questions, however, were shorter in terms of time, but not significantly.
- As for student group activity, using books or writing, DL students significantly (p=.02) spent less time writing (:55) than the non-DL students (9:55), with less frequency (.07 vs. 1.07, DL/non-DL).

Where the comparison DL (German) and non-DL (French) classes did differ is interesting. These classes were taught by the same teacher. In non-DL, the teacher spent more time asking questions (on average 6.34 minutes per period) compared with DL (2.42 minutes). However, the two classes did not differ in terms of *number* of teacher’s questions. The difference reflects the fact that in non-DL the teacher took more time to ask each question rather than asking a greater number of questions. This seems to be substantiated by his own experience of the two situations; he reports that he felt that he needed to put more energy and effort into keeping remote students interested and involved.

With the subject area and teacher as a constant, the comparison data provides an opportunity to look at the quality of instruction and the role that DL technology plays in mediating instruction to influence interaction. The field notes provide the context to eliminate the instructional approaches that precipitated the various interactions between teachers and students.

Learning a second language requires active speaking and listening activities as well as more reading and writing. In both the DL and nonDL language classes, student interaction along all these dimensions was greater than in all the DL classes in other subjects that were observed. Both classes had students speaking in unison which was a not a form of student interaction in other DL classes.

As mentioned earlier, a key finding was that the nature of the subject matter and the teacher mattered more than the technology. In comparing the two language classes, taught by the same teacher, you can begin to see areas where technology did have a subtle impact on how the teacher accommodated his teaching style to DL classes. In comparing the two classes, it also seems apparent that the teacher was also accommodating the differences in class size and the students varying interest in and engagement with the subject matter. (The nonDL French class began the school year with three times as many students than the DL German class, and ended with twice the number of students.)

The differences in student interaction between the DL and non-DL classes can be attributed largely to the teacher's choice of instructional approaches and strategies. In gearing the curriculum to the smaller number of engaged students in the DL class, responsive readings of extended length and difficulty were used more often. The larger non-DL class, with a wider range of students, focused on more short answer and worksheet -based instructional methods. The difference in teacher telling between the classes (14:54 in DL and 9:44 in non-DL) can be accounted for by the more expansive explanations that were often required to illuminate nuances in language usage that were encountered by DL students reading and discussing more sophisticated narratives. While there was no significant difference in the amount of time students were telling, either individually or in group recitation, there was a qualitative difference resulting from the instructional materials used.

Another significant difference was in the amount of writing engaged in by the DL and non-DL students. While both classes used coordinated audio-visual and print curriculum materials, the materials for the DL class did not arrive till almost the second half of the semester. The non-DL class used its materials from the beginning of the year. In this class there was an established routine of completing homework assignments geared to their curriculum and then discussing them in class, or vice versa. Thus the workbook exercises served as a focus for student writing while individual students responded to the questions or exercise assignments orally. In the DL class, the audio-visual and printed worksheets were used more as a guide to general class discussion rather than the focus of the lessons. This level of engagement can also account for the DL students asking more questions than the non-DL students.

Another difference can be noted about the use of comparable technology, for example the similar roles that the document camera and the chalkboard play in DL and nonDL classrooms, respectively. It was noted earlier that the teacher wore a wireless microphone in the DL classroom to maintain visual contact between the students in the home and remote sites. Since the teacher sat with the students to be on camera, this meant that he was physically separated from the document camera which was located at the teacher's podium. By contrast, when the teacher taught the non-DL class, he stood in

front of the room where the chalkboard was readily accessible. This separation from the document camera meant that when the teacher made the effort to move to use it, it was important enough to require an explanation of some length.

On the dimension of sociability, the teacher used humor and rewards in both classes and appeared to be well-liked by students in general. However, as the teacher noted in interviews, he worked hard to make the DL class feel as one class. The increased level of social interaction in DL may be attributed to this conscious effort to span the distance with remote site students.

We also compared the nature of interactions for home and remote sites. Overall, there were no systematic differences in how students were involved in interactions based on their location at home or remote schools. There were a few differences for individual classes, some of which could be accounted for by the small number of students at one of the locations. In two of the classes, the remote students were more verbal. Individual remote students in the AP Biology class talked more frequently than home students (6.6 times per period on average compared with 3.6), but average times did not differ. Remote students thus had more but shorter turns. Likewise remote students in German asked more questions than home students (an average of 10.1 per period compared with 4.8).

In sum, our analyses of the interaction in classes suggests subtle rather than major differences in interaction when DL is compared with traditional instruction. It suggests that subject matter and teacher are more powerful influences on interaction than the technology itself. But it also points out the relatively low level of student questioning and sustained discussion in these high school classes, whether or not they involve the technology. In light of teachers' goals and current research evidence, this aspect of the design of courses merits further examination and discussion.

Technology

Many educational implementations of technologies are plagued with technical problems. In light of this common experience, the Dutchess County DL project has been remarkably free of such complications. Teachers and administrators report only very minor problems. During the first year teachers estimated that they encountered one problem per month, and that most were solved within 5 minutes. Most of these problems were with the audio. During the second year, teachers reported very infrequent problems, and the amount of time spent solving them was negligible. According to their accounts, the technology quickly became "invisible." Since the overall goal of the project was to integrate DL into the existing structure — providing innovation primarily through the courses that could be offered — the technology cooperated well by "disappearing" from notice in terms of technical complications.

Administrators likewise were aware of very few technical glitches. They noted the importance of a good, qualified aide to a smoothly functioning system. Ironically, they also felt that the technical support personnel from the suppliers did not visit frequently enough.

These perceptions of virtually problem-free functioning were confirmed in both our survey data, and our classroom observational analysis. With respect to the teacher survey, "problems with the equipment" was the lowest ranked barrier to effective DL. Audio problems were noted most frequently, with 21% reporting this as a problem and 45% indicating that they did not experience audio difficulties. All other technology barriers were given even lower ratings (see Appendix C). Teachers were asked to rank a second set of possible problems, and again technology "glitches" sunk to the lowest on the list.

Interestingly, these teachers also did not feel that the technology interfered with the educational experience. For example, few thought that the technology limited spontaneity (7%), or that students were disturbed by the camera (4%). They also did not believe that the close association with television reduces the pedagogical value of the DL experience, or that being on camera is a distraction for students (7% found each of these a problem).

The observational data confirmed teachers and administrators perceptions that technical problems were quite rare in the DL classes. As part of our observational protocol in the four DL classes, frequency and duration of use of the various technologies were recorded, as were any problems. Technical problems were observed in only one class of all the observations, and this happened only twice for an average of 2.36 minutes.

In each DL class, teachers had the following pieces of equipment available for their teaching: document camera, VCR, audio recorder, fax, telephone, and hand held calculator. The document camera was the most frequently used piece of equipment in all classes. The VCR and audio equipment was used quite infrequently, and most often in the AP Biology class where it was used for 5 minute segments on average when it was used. The fax machine was used even more infrequently: only once in each of three classes and not at all in the others that were observed.

Many teachers report that they would like more training in the integration of some of the available technologies for their classes (see below): 55% thought that professional development in the use of graphics and media for the DL classes would be an important improvement.

With respect to desired technical improvements, all those that were highly rated concerned *tinkering with image quality*. Many teachers wanted monitors with better resolution (59% vs. 19% who did not think this important); "better monitors" was ranked second highest of all possible improvements for DL. Many also wanted larger monitors (56% vs. 4%), or separate monitors rather than split screens (55% vs. 10%). This interest in improved image quality is plausibly related to the concern for relationship, for *knowing* each other in these classes. When connected through video and audio, the reliability and acuity of the media seem essential to establishing enduring human connection.

Selection and Recruitment: Teachers

Twenty-seven teachers responded to the DL questionnaire (28 overall), of which 44.4% were men and 55.6% were women. The mean age of the DL teachers is 49.8

years, which is slightly older than the national average. More than half of the teachers are very experienced (54%), having taught for more than 15 years. But a significant group (31%) are relatively new, having taught for 5 years or less.

Over half of the teachers teach more than one grade: 81% teach 12th grade; 62% teach 11th grade; 54% teach 10th grade; 54% teach 9th grade; and 15% of the teachers reported teaching college. Eight of the 26 teachers (31%) teach foreign language, 23% teach science, and 15% reported teaching either English or social studies.

These teachers are relatively experienced with respect to technology: 79% report using computers in their personal lives, and 64% in their teaching. Likewise, 96% report using video in their teaching, probably reflecting their participation in DL; fewer report using video in their personal lives (83%).

The DL teachers in this cohort were, as a group, experienced in both teaching and using technology before they took on DL. How were teachers selected or recruited? For the most part, administrators report that the DL volunteers were solicited after initial presentations about the DL initiative at schools. Some, however, were recruited to teach specific courses that were needed by schools. A few others were perceived to have qualities that would help them do well in the DL situation. From administrators' points of view, such qualities might include people who are outgoing, not intimidated by an audience, devoted to education, and not overly concerned about maintaining tight control in a classroom. There was some feeling that a DL assignment was "not for everybody," but also belief that those who were comfortable adapted to the situation fairly easily. The administrators were aware that many teachers experienced performance anxiety at first, but believed this quickly dissipated with experience. One non-DL teacher reported that there was some sense in at least one school that those not involved in DL should "stay away."

Teachers believed that individuals were encouraged to join DL based on the courses that the "system" wanted to teach. DL and non-DL teachers alike report, however, that people were asked "not forced". Of three DL teachers who discussed this in interviews, one was an enthusiastic volunteer, one was recruited, and one who had been seeking a job agreed to teach DL to secure a teaching position.

Professional Development/ Training/ Support

Generally, most teachers and administrators felt that the DL program would benefit from more, and more advanced, professional development. While administrators believed that teachers had adapted easily to DL, some also felt that more support was needed to help them develop a variety of teaching styles to use DL to full advantage, and to use it more flexibly. After several semesters of experience with the system, some were relieved that problems with student discipline in the DL situation largely failed to materialize. But they did become aware of other issues that some thought would benefit from increased training/support, such as the relationships among teachers and students in DL classes (above). In addition, some emphasized the fact that DL easily reinforced traditional lecture-style pedagogy rather than encouraging innovative approaches: it could be seen as constraining teaching style.

Administrators reported that the teachers were largely self-monitoring, and that the BOCES provided opportunities for discussion that teachers came to rely on. Bimonthly DL staff meetings were held by the BOCES, and appeared to be adequate for the staff. However, some administrators expressed concern that they have no direct authority over remote teachers, and therefore no mechanisms for supervision, for improving course quality, or for correcting problems of a remote site in collaboration with a distant teacher.

In their interviews, teachers uniformly reported that they had received significant support from the administrators for DL, including those at BOCES. They thought that BOCES was "great" in assisting them, that the initial DL training supplied by BOCES was "adequate" to "good". But all thought that more, and more advanced training would be helpful. The initial training was largely on the technical aspects of using the system; there was not sufficient time initially, or continuously, to work on the difficult issues of curriculum and pedagogy in this setting. The complex issues surrounding the problems of "relationship" were also not featured, and left the teachers on their own to devise remedies. This set of issues is the key to understanding how technology can have an impact on pedagogy.

More than half the teachers in the survey (52%) indicated that additional teacher training would be a substantial improvement for the DL program, with an additional 22% reporting that it would be a moderate improvement. As noted above, 55% of the teachers wanted more sophisticated training in using graphics and media in DL; only 14% reported that they were not interested in this. In addition, 39% were substantially interested in spending time outside class brainstorming and discussing their experiences with other DL teachers.

Teachers also expected that involvement with the *technology would help them to perform and develop professionally.* With respect to DL advantages, 70% agreed that it would enable them to teach subject matter they wanted to. When asked about their current thinking about DL experience, 56% agreed that it enabled them to grow professionally. Further study is needed to understand what teachers meant by meant by professional development.

Parents

Administrators reported that they believe most parents of students are at least aware their children are enrolled in DL. At one site, parents are required to sign a contract about DL participation. However, few parents visit to see the DL environment. Administrators also believe that those parents who do not have children enrolled in DL are largely oblivious to it. A few parents don't want their children to take these classes because they don't want their children "watching TV to learn." Many schools have had open houses to address any parental concern about DL, with often lackluster attendance. Most report the absence of parental complaint, and that some are quite enthusiastic.

Student interviews confirm that many parents were generally aware of the DL network, and thought that it was a good program for the school to offer.

> "My parents thought it was a good way for me to get AP courses that wouldn't have been offered otherwise."

> "My parents knew it made classes available to me. What would I have taken otherwise? Basket-weaving?"

Others, however, commented that their parents didn't really know that they were taking a DL class, or if they did, did not appreciate how it was different from their other classes.

> "My parents just wanted me to take German. They don't really care that it's on the network. They're just happy as long as I do well in school."

Future of DL

Overall, administrators began and remain very positive about DL, and in their belief that the problems are outweighed by the benefits. Only one felt that the project has been problematic since the outset; this view is from a relatively advantaged suburban school. The administrator feels that not all schools benefit equally: smaller rural schools have more to gain because they have fewer "content" resources locally available for their students.

Many administrators feel that the DL implementation is a positive force in their communities, some of which tend to have negative attitudes about school. They feel that DL indicates the power of being engaged in change, being at the forefront of technology and innovation in teaching. Most believe that such technology is key to the future of education and that their involvement puts these schools at the forefront. This deep sense of change, of future, and of long term commitment to exploring such strategies for the futures of their students, leads them to perceive any problems with integration as "worth it."

The teachers largely agree: 81% are in strong agreement that DL is part of the future of education. And 63% perceive that students are proud of their schools for DL. However, teachers balance their enthusiasm with concern about resources, and with the traditions of good teaching. Only 12% strongly believe that it makes sense to "funnel" substantially more resources towards DL, and 69% strongly agree that DL has its place, but will never replace "regular" teaching.

Expanded Use

Many of the administrators were not satisfied to think of the DL system as being complete in its present form. They not only talked about DL as a way to enrich the schools and the current learning environment, they also talked about their hopes that the DL technology they have received as part of this initiative can be used more broadly in the future. They were beginning to discuss ways to "enrich" the "enriched DL learning

environment." One hoped to see a day "when the system is up and running most of the time." In addition to conducting high school classes on the network, they see using it to connect teachers and administrators at different sites, putting it at the disposal of adult education in the community, and using it for other civic/community purposes.

> "DL has not yet reached its potential to really 'restructure' education as it is currently being touted. A serious concern is the lack of classes beyond the regular school day. We think of learning occurring only between 8 AM and 2 PM. If we went beyond that, real change could occur. DL could be running from 6 AM to midnight and thus extended to adult learners. We could help support the concept of a community of learners and life-long learning, integrating kids and adults learning together. It might even strengthen families and bring them together. Greater accessibility is what's needed."

There is also a sense emerging from some of the administrator interviews — especially where acceptance of DL still faces some hurdles — that improved communications might help with the integration process. They had concrete suggestions to make including more communication from BOCES to all teachers (not just DL teachers) and handbooks for students that help orient them to the differences they are likely to encounter in a DL classroom.

Other suggestions for expanding and enriching the DL learning environment included: extending the use of the DL technology within the school community (for extracurricular activities, student meetings), more efforts to allow kids to meet face-to-face occasionally, and technological improvements to free up teachers (e.g., a auto-tracking camera to allow teachers to move around the room).

Learning

The data concerning students and learning are summarized below according to seven overall themes:

- Students' expectations
- Students' experiences of DL classes
- Achievement
- Attendance
- Technology
- Relationships and interactions
- Student selection

Student Sample

As noted above, 24 students were interviewed in-depth about their experiences. Questionnaires were completed by 223 (67% return rate) of the total 322 students enrolled in DL during the 1994-95 school year. Of the sample of students who returned the instruments, 46% were boys, and 53% girls (see Table 6). About half (53%) of the students were in 12th grade, 27% were 11th graders, and 19% were in 9th or 10th grades. 219 students reported gender; 222 reported grade level.

Table 6
DL Students' Grade Level by Gender

	9th Grade	10th Grade	11th Grade	12th Grade	College	Total
Male	11 (11%)	12 (12%)	25 (24%)	55 (53%)	0	103 (47%)
Female	12 (10%)	7 (6%)	35 (30%)	61 (53%)	1 (0%)	116 (53%)
Total	23 (10%)	19 (9%)	61 (27%)	118 (53%)	1 (0%)	219

Half of the students in the sample (50%) experienced DL in the home school site, 36% in a remote site, and 14% had experienced both home and remote DL classes. More girls (60%) than boys were in DL home-site classes.

Students estimated their overall school performance by ranking themselves and reporting their grades: 98% of the students in the sample believed that they are good students, ranking themselves either average or above average (52% above average and 46% average). Students reported their previous year-end grades in four subjects: English, science, mathematics, and social studies. Over 80% of students noted that they received grades of *A* or *B* in all four subjects (see Table 7). High achieving students (*A* students) appear to be attracted to both home and remote site classes at the same rates.

Table 7
DL Students' Grade Average
(for Math, English, Social Studies, and Science) by Gender

	A 90-100%	B 80-89%	C 70-79%	D 60-69%	F Below 60%
Male n=91	36	40	13	1	1
Female n=104	61	35	8	0	0
Total n=198	100 (51%)	75 (38%)	21 (11%)	1 (0%)	1 (0%)

Overall, these students appear to be relatively experienced with various technologies: 87% report that they use computers in their personal lives and at school. By contrast, in 1995 about one-third of all households nationally have a computer.[8] Many students claim substantial experience, with 58% reporting 3 or more years of use in school and 63% at home. Almost all students (92%) use video at home, whereas 66% report in-school use. More students than the national average use CD-ROM at home (41%).[9] Likewise, a relatively high percentage report using telecommunications (modem): 26% at home and 34% at school; about twice as many boys than girls report telecommunications use.

Students' Expectations

Many students echoed the sentiments of administrators and teachers that DL allows them academic experiences they would otherwise not have had. Thus, the primary reason for DL was a *content*-related one: 74% of the students strongly agreed that the top advantage of DL was access to *unique* courses. Only 12% disagreed with this statement. Likewise, 50% of students strongly agreed that an advantage was access to *richer* course content. 62% reported that DL had allowed them to take courses not otherwise available to them.

New or unique content thus rated high in students' rationales for selecting DL. The most influential goal for choosing DL, reported by 63% of Dutchess students, was taking courses that would not otherwise be offered. A higher percentage of girls (66%) than boys (58%) reported this as influential (mirroring high achieving students). Also, 72% of the students who experience DL with teachers at both sites reported this as an important influence, compared to home (61%) and remote (60%) students.

The second most influential goal reported by the Dutchess students (41%) was the possibility of doing and being part of something new and different. This echoes administrators and teachers enthusiasm for DL as a harbinger of the future, albeit at a slightly lower volume of enthusiasm. Interestingly, a higher percentage of students at home sites (48%) and sites who had experienced teaching at both (47%) sites (home and remote) reported that being part of something new and different was an important influence, compared to 30% of the distant site students. Many students (38%) were also influenced by the possibility of using and experiencing new technology.

Table 8
Goals and Ideas about Distance Learning

	N=	Important Influence (%)	Indifferent (%)	Not an Influence (%)
Possibility of taking courses not otherwise offered	222	63	20	17
Possibility of doing and being part of something new and different	221	41	38	21
Possibility of using and experience new technology	222	38	37	24
Possibility getting acquainted with students from other schools	222	36	34	30
Satisfy curiosity when saw DL room or heard about DL from others	222	29	32	39
Encouragement of teacher or guidance counselor to enroll	222	23	25	53
Possibility of getting acquainted with teachers from other schools	222	17	31	52
Possibility of talking on TV with other students and being on camera	222	16	33	50

The highest rated factor, the possibility of taking courses that would not otherwise be offered, reflects the type of DL classes offered in Dutchess, mainly advanced placement courses and electives, like oceanography or public speaking. Due to fiscal cutbacks in the last few years, many schools, particularly in the rural communities, could not afford to offer advance placement classes or electives. Therefore, it appears that students view DL as an opportunity to enhance their school experience. Overall, less that one quarter (23%) report that teachers or guidance counselors recruited or greatly affected their decisions to enroll in DL.

Some of these students had taken more than one DL class, others had just one experience. Several commented in interviews that course selection was what drove their choice of DL (i.e., the need or desire for a language class or an AP class that was only available on the network).

> "I needed a science course, and my counselor recommended AP Biology because I do well in biology, and I wasn't sure I'd pass physics. I

> heard about [DL] from a friend who took AP Biology last year who said it was no different from a regular class. So I wasn't too worried."
>
> "I definitely wanted to take Japanese, and it was only offered on the system."

One student noted that he had expected that DL wouldn't be as good as a "regular" class. He said that he had been surprised when DL had exceeded his expectations. Another student said he had expected that DL would "definitely be unusual, but I got to like it more and more as the year went along."

Others students said they had been intrigued by the prospect of the on-line class experience.

> "I thought it would be a more interesting way to learn with the technology. Also, I could take the course for college credit [the BETA-hosted economics course], and that was a plus."

Some students also said that they had been a little nervous initially. The prospect of seeing oneself on camera was disconcerting at first, but most said they got use to it within a few weeks.

Students' Experiences

Overall, the students report a favorable assessment of the DL experience in interviews and on questionnaires. Some of those interviewed had initial misgivings about taking a DL class because they felt "camera shy" and couldn't imagine "how it would work." However, most commented that their initial concerns had not been borne out. Several said DL classes were better than they had expected. The consensus seems to be that DL classes are not so dramatically different from a "regular" class; this is borne out by our observational analyses and field notes of class interactions and class characteristics (see above). Of all students interviewed, only one articulated a clear preference for traditional classes rather than DL. This student found it difficult to focus in the DL class.

A large majority of students (88%) would recommend DL classes to their friends (see Appendix D). More home (94%) than remote (80%) students, and more girls (91%) than boys (85%) would strongly recommend DL to their friends. The students at the home sites (94%) would recommend DL classes at higher rate than the remote site students (80%). When asked what they would tell their friends about DL (the one biggest difference between distance learning and regular classes), 18% stated that it's a class to meet new and different people from other schools, 12% of the students said that you receive less attention from the teacher, 10% of the students stated that the classrooms are nicer and newer, 8% stated that there are cameras and monitors present, and 7% noting that you see yourself and others on TV and that the classroom is comfortable.

With respect to the format of the classes, about half the students (49%) strongly agreed that advanced DL classes were smaller and more focused, compared with 21% who disagreed. In interviews, some students felt that the set-up of DL lends itself more to lecture/discussion format, making small group activity or science labs more difficult. But lecture-format was not generally perceived to be a problem in DL. On the questionnaires, relatively few students (28%) reported that teacher-centered or lecture oriented classes were a problem (44% reported this was not a problem). However, about one-third (30%) of students thought that the lack of science laboratories was a problem for DL.

> "I didn't like the labs [as a remote student]. I felt cheated."

This supports the interpretation from the interview and observational data that students did not experience DL as fundamentally different in style from traditional classes. In interviews, most students felt that they were as effectively exposed to the academic material in a DL classroom as they were in traditional classes. Seniors said they felt well-prepared for their AP examinations. The workload was seen as comparable. Students reported that the teacher used the document camera rather than the blackboard, but this was not seen as an impediment, just a difference. Only one student in interviews commented that it was literally harder to follow the material from a remote site [the class was AP Calculus, and the student felt she had followed things well as a remote student in other subjects]. Occasionally, students commented that they felt DL classes demand more focused and concerted attention.

When asked about improvements, relatively few wanted longer DL class periods (24%, with 49% disagreeing), or a change in format that would allow more off-line group discussion (22% perceiving this as an improvement, and 50% disagreeing). Students' desired DL improvements tended to cluster around issues of relationships, and more use of various technologies than concern with the format or pedagogy of the classes (see below).

Overall, students reported remarkably few complaints or problems with DL. As noted above, the most frequently cited problem was the lack of laboratories in science cited by 30% of the students.

Achievement

To discover whether and how DL affected student achievement, we assembled both numerical grade data and performance on Advance Placement exams, where appropriate. We collected individual student numerical grades in all DL classes for the 1994-95 school year. We also collected each student's high school grade point average (GPA) in order to compare their DL performance with an indicator of their overall achievement. Where there were sufficient numbers of students to meet requirements for statistical tests, these were conducted to determine whether or not any differences were significant.

Advance Placement (AP) scores were collected for those students who took AP exams at the end of the term. These scores were compared with New York State and national average scores for those particular courses.

With respect to grade/GPA measures, there were 6 DL classes in which there were sufficient numbers of students for significance tests to be done. Of these, student grades in three of them were significantly *lower* than their GPA (AP History, Calculus, and Accounting). In two classes, student grades were significantly *higher* than their GPAs (sociology and anthropology), and in one (AP Biology) there was *no difference*. Conservatively, these data indicate no systematic bias of DL to affect student performance either positively or negatively overall.

To further explore this, we examined the *direction* of the relationship between DL grades and GPA for the remaining classes in which there were insufficient numbers of students for statistical comparison. Of these classes: DL grades were lower than GPA in 16 classes; DL grades were *higher* than GPA in 9 classes; and, DL grades were *equal* to GPA in 4 classes. Again, this suggests that there was no overall bias of DL to adversely affect student achievement.

How did students perform in AP DL classes relative to their overall GPA? Of the 9 Advanced Placement classes that were offered in DL, students' performance was lower than their GPA in 6 of them. They performed better than their GPAs in one of them (Spanish), and equal to in one (AP Biology). (One class had too little data for any meaningful comparison — for only 2 of the students.)

The emphasis in Dutchess county was to use DL to provide content that would otherwise not be accessible to many students. We therefore also examined performances in those classes that could reasonably be considered "advanced" curriculum for these students: anthropology; sociology; agriculture; business law and economics (eligible for college credit); "virtues" in literature and poetry; advanced French, German, Latin, Japanese; agriculture; oceanography. (There were two sections for some of these classes). Of these "advanced" classes, students' grades were: *lower* than their GPAs in 10 of them; *higher* than their GPAs in 5 of them; and *equal* to their GPAs in 2 of them.

We found no systematic difference in achievement when performances of home and remote-site students was examined, nor any systematic difference by school for students involved in the DL courses. If performances of students from one school in a DL class were worse than students from another of the participating schools, the former students' GPAs were also lower.

Finally, we looked at student achievement in the non-DL comparison class. Students' grades were lower in this class than their GPAs, although numbers were not sufficient for statistical comparison.

With respect to Advanced Placement achievement, there were sufficient students in three of the classes for meaningful comparison with state and national norms. DL students did well overall in 2 classes relative to norms. For AP European History, 18 DL students took the AP exam and performed notably better than the comparison groups (an average of 3.84 compare with 3.15 NYS mean, and 3.13 national mean score).

For AP English, 20 DL students took the exam and scored comparably (3.0) to the NYS mean (3.03) and the national mean (3.11).

DL students' AP scores were notably lower in 1 class, AP Biology. The mean score for the 27 students who took the exam was 2.52, compared with the state (3.43) and national (3.14) norms. We can only hypothesize various reasons for this difference; further inquiry would be needed to explore it. For example, the cohort of students could be substantially different in preparation or aptitude than students in other cohorts; various characteristics of the class affected student learning; or, teachers' and students' concerns about difficulties conducting laboratories in DL were well-founded.

Overall, these data do not indicate that DL alone systematically impacts student achievement. In some classes, students performed better than their own averages and national norms, while in others they performed equivalently or worse. There was no large bias toward either end of this achievement continuum. Further and more fine-grained inquiry about DL designs and circumstances that influence achievement would be needed to understand the complex of factors that likely influences achievement in the technology-enhanced classes.

Attendance

We examined whether and how student attendance at classes may be affected by enrollment in DL. Attendance is a special challenge in light of the scheduling difficulties discussed above. Attendance data for individual students at DL classes was collected for the semester or year along with their overall attendance record at school. (School attendance is taken in homeroom, and thus we do not know how DL class attendance may relate to attendance in other traditional classes).

There was sufficient attendance data available for statistical comparisons in 3 of the DL classes. Of these, there was *better* attendance in 2 of these DL classes than students' overall records, and *no difference* in attendance for the remaining one.

There is thus no evidence that students systematically avoid DL classes relative to overall student attendance. These attendance data are particularly remarkable in light of the scheduling difficulties for these classes.

Technology

Students were interested in the technology. Almost half (46%) reported that they would like a greater role in operating the equipment, and more than half reported that they wanted *more* technology to be used in these classes: 52% wanted more multimedia use, and 51% wanted more use of communications technologies.

As we found above from the teachers and the observational data, student data confirmed that there were very few problems with the DL technology in their classes. Consistent with the other data sources, audio problems were most frequently noted: 22% of students reported problems with hearing or being heard; 21% found problems with the functioning of the sound equipment. Overall, 42% of the students would like the sound to be improved. Most reported there was no problem with other technologies, including the telephone (81%), the document camera (77%) or with camera motion (70%).

However, many students believe the DL situation would be improved with more flexible room design (62%). Like the adults, a substantial number would like the video monitors to have better resolution (39%, vs. 30% who did not view this as an improvement). In interviews some students suggested that it would be better to focus the camera so that they could see students at all remote sites, rather than seeing themselves on the monitor. Another suggested a fourth camera to allow students throughout the class to continuously see each other. Some students felt at particular disadvantage given the video limitations. One African-American student commented:

> "The color on the monitor stinks. I sit in the back of the room, and I just look like a black dot."

Relationships and Interactions

The students underscored that it is in the realm of human relationships and interactions that the "virtual" classroom is most challenging. The on-line medium impacts their ability to relate to the teacher (especially when the teacher is at a different site) and to relate to their peers at remote sites. Relatively few students reported that getting to know the teacher at another school was an influential factor in choosing a DL class (50% said that it was *not* a factor). Once they were in the course few complained in the survey that it was difficult to get to know the teacher (18%, vs. 58% who did not think so).

However, many (61%) thought more in-*person* contact with the teacher would be a significant improvement for DL. This was echoed in the student interviews. This apparent contradiction may be clarified in the interviews. Many students commented that despite the fact that the virtual classroom experience makes it more difficult to really *know* the teacher, access to the teacher for help with classroom material was not a problem. Students in one class, for example, reported that they used the DL system outside of class time as well as the telephone to get extra help from the remote teacher.

> "I wouldn't mind meeting the other class. We met the teacher. He came to our school twice. You could transfer him here. We love him."

> "The Japanese teacher comes to our school every Friday to teach from the remote site and I interact with him more on those days. You can still learn on the system, but I like the in-person contact."

The distinction between satisfactory *interaction* and *relationship* noted in the adult data may also apply to students' experiences of DL.

About one-third of students reported that getting to know students at other schools was an important reason to enroll in DL (36%, vs. 30% who felt it was not). In the interviews, many students raised the issue of knowing students at other sites as a

problem. The feeling of impersonality and not knowing one's fellow students, not being a "whole class" bothered some.

> "You don't really get to know the remote students. You talk over the video a little bit, but you don't converse typically in class, so you don't have real personal contact."

However, the majority of students did not feel that the kinds of interactions that took place in DL classes were significantly problematic. About one quarter of students reported in the survey that getting to know the other students in class was a substantial problem (28% thought so, vs. 44% who did not). Likewise, few felt there were problems with overall interaction in the DL classes, or that shyness intervened (14%, vs. 65% who did not think this a problem).

This is consistent with the fact that our observational analyses suggest that the nature of interaction in DL was relatively consistent with that in traditional classes. Student talk, either questioning or "telling", accounted for a very small fraction of class time in both DL and non-DL classes (see above). However, in interviews, some students *perceived* that their DL class had been more interactive, with more student participation than usual. Though they don't explicitly say so, it may be that they prepare themselves to "overcompensate" for not being in the same room. As a result, they feel they participate more than they normally would, and indeed this may be true for some.

> "I took an AP English course from a teacher at Webutuck. It was better than the teaching I've had in traditional classes because it was so interactive. As a final, all three sites were doing Saturday Night Live skits."

However, when asked about improvements to DL, as noted above, the top suggestions were in the category of relationships: 61% of students strongly agreed that more in-person contact between teachers and students was desirable, as compared with 11% who did not want this. More girls (66%) and more remote students (68%) wanted this improvement. Many students also wanted more in-person contact among students (52% who strongly agreed, vs. 17% who did not want this).

> "You don't get to know the other kids really. I hardly knew any of their names. Some kids at the home site didn't even know who was in our class until the end of the year when they got to do a presentation. We said, 'who the hell is that?"

> "It would have helped if we had met the kids from Spackenkill. It would have been easier if we had known them. After we met the teacher face-to-face, it was easier to see him everyday on the monitor."

Few students thought that technology was a good way to address this desire for contact and communication (20% who agreed, vs. 52% who did not). Interview data confirmed that many students had never met their DL teacher in person because of difficulties fitting between-site travel into their teaching schedules. Few had met their fellow students, although they would like to do so.

Student Selection

Students overall felt that they themselves selected the courses. Relatively few (23%) reported that they relied on or were recruited by teachers or guidance counselors. Several students noted that there is a lot of interest in the general student body about the network, but not all students are interested in the limited range of courses taught. Many thought it would be a good idea to diversify the types of DL courses taught so that more students can have DL experience.

> "A lot of kids are interested in DL, but they don't like the courses offered. They repeat the same ones every year. They should have more variety so more kids can participate. I think they would."

Some students noted that their peers have misconceptions about DL:

> "Other kids who haven't taken a DL course think all you do is watch TV. They think you don't have any homework and that it's real easy."

As noted above, there was a difference in perception between administrators and teachers about who DL was for. Some administrators were interested in the use of DL for special needs students, as a way to incorporate, for example, those educated in a physically separate facility. Teachers, in contrast were much more reserved in their enthusiasm about the range of students who could function well in DL. Most felt that to be successful, DL classes required focused, motivated students. 85% of teachers believed that DL requires more mature, highly disciplined and motivated students, compared with 7% who did not believe so. The possibility of engaging students who were "at risk" was among the lowest rated goals for DL by teachers; 67% did not think this an important goal for the system. Few (16%) thought the system would benefit a broad cross section of ability levels; 46% did not perceive DL as an advantage for mainstreaming students.

In general, the "culture" of DL emphasized the use of the system to provide advanced or unique courses to students who were bright, motivated, and disciplined. This was consistent with the overall reasons for investing in DL. The experience of the experiment with the system to include special needs students in the BETA site was mixed. Some teachers believed that this feels good for students, but that it is difficult for the teacher to deal with a wide range of ability levels in this situation. Certain of these students do well, but some thought that most are not mature enough to deal with the DL situation. In addition, the BETA students brought a different set of expectations about

format of classes to DL than did the other students. Since they are "all over the map" in terms of ability, the primary mode at their school is in-depth individual study guided by the teacher. Students thus set their own pace of study, and this is typically a slow one. Formats based on whole-class lecture, discussion, role playing are rare in their high school experience. It also requires them to adapt to the pace of the class, and to be self-motivated to keep up. This worked for some, but not others. According to the teacher and aide, DL puts higher performance demands on these students; some respond to this pressure ("they succumb to positive peer pressure"), and others don't.

So, these students are coping with an educational format in DL with which they are either unfamiliar, or with which they have been unsuccessful. DL provides more communication and interaction with other students than is normal for them. That this can be difficult for these students is attested to by the fact that of 7 enrolled in one of our intensive sample classes at the beginning of the semester, one remained at the end.

Case Study

The BOCES Education and Training Academy (BETA) site was one of the initial pilot sites chosen for Distance Learning in Dutchess County. BETA is an alternative high school for students who have been unable to succeed in more traditional school environments. Such a site offered an immediate test of the goal of broadening the range of students who participate in the new and enriched instructional program being designed for the Distance Learning network in the County. Once students come, either by choice or last resort, they usually stay to complete their high school education. Since students rarely go back to their home districts, there is little need to synchronize BETA's curriculum with a student's home school. The students are usually one or more years behind academically. Reasons for attending BETA vary. Students may be disaffected with school, e.g. unable to cope with a traditional classroom environment or feeling lost in a large school, or have behavior, drug or alcohol-related problems. Some choose to come, but for the majority its the last chance.

Since BETA enrolled only 77 students at the time of the study, the opportunities for expanding the curriculum offerings for students typifies the experience of other small high schools in the county. Through DL, BETA students have been able to take elective courses that they wouldn't get otherwise, such as oceanography or AP English. DL also provides a way for the BETA students to maintain some contact with students from other districts. In the judgment of one administrator at the BETA School, "It has done everything it was supposed to do." Both having an enriched curriculum and the opportunity for students to engage their peers in traditional high schools were seen as important benefits. The administrator from BETA thought, overall, that DL offers her students a lot.

> "Most kids can manage pretty well in there. Some kids may be nervous at first, but I think it really helps with their social skills, requires them to get their act together, think

> about what they say or do, and be more aware of themselves. Because our school is so small, only 77 students, most kids will probably experience DL at some point because it's the only option for taking some courses."

The administrator noted that another important side benefit of having the system was that BETA staff could confer with staff from a student's home district without either party needing to travel. She had scheduled at least two conferences of this type that were convenient and successful and anticipated using the system more often for this purpose.

Impact on Student Learning

The DL experience provides students an instructional experience that is atypical at BETA. Students generally come to the school because they are not succeeding in the traditional environment. Students thus bring an uncommonly wide range of experiences and abilities to the school. To accommodate this range, the primary instructional mode at BETA is independent study, guided by the teachers. Because students work at their own pace, whole group learning activities, such as lectures, discussions, role playing, and so forth, rarely occur.

By contrast, the DL classroom, because it combined traditional students with BETA students approaching a subject together, tended to provide more large group activities, such as teacher- led discussion. DL classes afforded more communication and peer interaction for students. The teacher concurred that "DL enhanced the learning opportunities for BETA students, if they made the effort to stick with it." He felt that the first year Participation In Government was offered through DL, the students in this section worked harder than his non-DL students. Because of the "presence" of traditional students in remote sites, students are expected to (and consequently do) make the effort.

The teacher aide who worked with the DL teacher also sees student behavior as "much improved" in the DL classroom and attributes it to exposure to "positive peer pressure" from remote students.

> "It makes the kids try to do well, that they don't want to be perceived as the school for "slow" students or less than "normal" students in the district, so they rise to the occasion."

Academically, she thought BETA students could do as well or better than traditional students with the content delivered through DL. She noted that some of the oral presentations of BETA students in the Participation in Government class (see below) were on a par with those of the remote students, and some may even have been better. Every year she sees more and more interest in DL on the part of students.

The teacher sees that a major drawback with the "work at your own pace" mode of instruction at BETA can be that the student often sets a very slow pace. But, as the Aide indicates, in the DL class, when exposed to more self-motivated students from remote sites, the BETA kids are forced to keep up and do more.

> "There is an atmosphere of participation in DL unlike their other classes that challenges them to work to a higher level. Also the fact that the DL courses are college level challenges them as well." (Teacher Aide)

The teacher's final assessment is that certain BETA students do well in DL courses, but the great bulk of them do not have the maturity to do DL or college-level work. In reality, DL classes challenge teachers to respond to a wide range of students, from good to indifferent at times.

The need to screen BETA students for maturity and commitment to the content in order to participate in DL classes contrasts with the current practice of placing students in these courses. As the Administrator noted, students are not selected out for DL; it's just part of their program. If they need an Economics course, they would be scheduled for DL as it's the only Economics course offered. She also indicated that students with behavior problems might not be put in the DL class, but that is rare. The "DL-only option" for some courses may eventually present a problem for some students precisely because the DL classes closely resemble more traditional classrooms where these students were unable to cope with the academic and social pressures in the first place.

The Distance Learning experience at BETA is ambitious in design and intensity. It is also not without its own problems. During the research, BETA was "hosting " three courses, all taught by the same teacher. No other teachers expressed interest in teaching DL. However, the school administrator feels that if she approached them, others would be interested and give it a try.

Focal Class Experience

We interviewed the DL teacher from BETA twice. Comments from these two interviews are combined here in order to reflect a maturing teachers' adjustments to a challenging teaching situation. Altogether, this teacher had four years of experience in teaching DL.

During his initial year (which was also his first year as a teacher), he taught one course on-line as a part time teacher. Education was a second career for him, having been a successful lawyer for 15 years prior to coming to BETA. His initial reaction to his DL assignment was nervousness, as he was new to both teaching and distance learning. He was concerned with just trying to survive in the classroom, and he thought that DL would make it harder to perform as a teacher, adding another pressure. He had been trying hard to get a teaching job, and the part time DL course was offered to him. He came in one day to see the room, and was shown how to work the controls. The next day he started teaching. He thought that DL would be a good idea for BETA students, giving all of them an opportunity to connect with other students in traditional settings and giving those with ability the opportunity to earn college credit.

Halfway through his second year this teacher acquired a full time teaching load through the addition of two DL courses. Subsequently, his teaching load included one DL course combined with non-DL classes. But during the year in which this research took place he was teaching DL exclusively. Over the course of the years, he taught the

same three courses—Business Law, Participation in Government and Economics in varying combinations. He has taught a wider range of both classes and students than any of the Dutchess DL teachers.

During the year of research he taught 3 classes exclusively on the network. In his view, teaching 3 DL classes exclusive of traditional classes was difficult for a number of reasons. Teaching both types of classes and students was a refreshing change of pace which he missed. He also missed the personal contact with students that typifies the BETA classes. Although he does have contact with his host site students in DL, the quality of the time is different because of the demands of 2 sites and trying to keep the class together. The amount of work in doing three separate preparations was tiring and taxing, although he got used to it as the year went along. He would advise that the number of preps be limited and extra time provided for anyone carrying this heavy a DL load.

His favorite subject is Economics. The school and DL administrators decided to offer Economics/Participation In Government from the social studies curriculum because it would offer a unique possibility for students from other districts to earn college credit through the special arrangement BETA had with Dutchess Community College. This turned out to be an attractive feature to other districts and the courses have been popular. It positioned BETA as having unique instructional capacity to offer to other districts. The administrators felt comfortable putting the new teacher on the network because of his previous career experience. Business Law was selected because students at BETA liked the course, and it was easier to attract students from other schools than more common offerings, such as math or science courses. Remote students signed up for the course because it gave them an opportunity to take a course not offered in their schools. Eight of the 12 students said they had an interest in careers in law, and they now know something about it .

Communication

An important goal for the teacher was trying to have the kids think of themselves as one class, even though it was clear to him that they do feel separated from their classmates because they are on the network. The DL classrooms, because they combine traditional students with BETA students approaching a subject together, provide opportunities for discussion that are not part of BETA students' typical educational experiences. Given this circumstance, DL classes afforded more communication and interaction for them, which could, and sometimes did, become inhibiting to these students who were not used to so much peer interaction.

The BETA teacher feels that, in general, communication between students is "pretty good," both on a personal and an academic level. He has observed students arrange dates, get into arguments, and puzzle out a real understanding of each others' positions over the network. The students had a slightly different view of in-class communication, however. Students at one remote site, when interviewed, said that students were unintentionally cutting each other off in discussion because they couldn't hear the other students. Students often became frustrated about this technical problem. "When you have two schools, everybody wants to answer." The students talked to the

teacher about it, and the problem was aired. They decided to try "new" strategies such as raising their hands to be called on rather than just beginning to talk. It worked for a while, but some students at one of the remote sites revealed at the exit interview that some kids just decided to keep quiet and let the other kids talk.

> "We should have met kids from _____. It would have been easier if we knew them. After we met the teacher face- to - face it was okay to see him everyday on the monitor. "

Meeting students' extracurricular needs was more difficult in the DL classes, according to the teacher, who indicated that the remote students had to depend on the telephone primarily. Both the teacher and students initiated telephone contact. The teacher also went to remote sites to meet students and arranged field trips as part of class so students could meet. During the year that he taught three DL classes, he had less personal contact with remote students because of the back-to-back schedule DL courses. In the past, with a varied or part-time schedule, he was able to travel to remote sites with more frequency to conduct classes or meet with students. Field trips help, and he did take classes on some trips (e.g. Poughkeepsie Court House), but there were fiscal and time constraints on the number of trips that could be arranged.

Students, on the other hand, didn't feel that access to the teacher was a problem. If they had questions about a class project, they indicated that they would just ask over the system or use the telephone. An aide said a remote student who was absent came in and used the system to talk to the BETA teacher about her project after she had been absent for a few days. Because the remote class was still in session for 10 minutes after the students at the other site left for other classes (the bell problem), students at Webutuck used that time to talk to the teacher or get extra help.

Classroom Management

Classroom management was not a problem in DL classes. Some students sat off-camera by choice, but the teacher knew everyone's voice, and could readily call on those students he could not see. Students indicated that they, "Can't cut up here like regular class. Mrs. Nubine (aide) is on top of us." The classroom aides assigned to DL in the remote sites were always present to ensure the technology was working and provide supervision for students. The BETA teacher/facilitator, who loves the DL experience so much that she has changed her college major to prepare for DL work, sees student behavior as much improved in DL classroom and that students "succumb to positive peer pressure."

The teacher and aides generally engaged in brief exchanges at the beginning of the period which usually included a greeting, information about student homework or assignments, absences, and any scheduling changes that might disrupt the class (weather, assemblies, vacations, etc.) and how to accommodate them. The aides typically performed only administrative duties, but occasionally would provide encouragement to

individual students, or participate in classroom discussion providing unique adult perspectives on social, political or economic issues that came up.

Although not a classroom management problem per se, the teacher did become concerned about the "drop" in student performance and attention of remote students in one class as it speaks to how distance can impact the teacher's ability to motivate students who are "off task". Although he had not corrected final exams at the time of our second interview, the BETA teacher was concerned about the overall performance of the these students for a number of reasons. In the spring semester, he realized that several remote students were not performing as well as they should be, and he became concerned about it. These were students who had demonstrated previously high levels of competence, who were now "dropping the ball." He had talks with them in class over the system, admonishing and cajoling them. He even tried to put "the fear of God" in them about the final exam. Nothing seemed to work. He discussed the situation with staff from the remote site and learned that it was not exclusive to the DL class, but that the students were giving other teachers problems as well. But the teacher concluded, that the physical separation between teacher and student as a result of distance learning may have contributed to the problem he encountered with the seniors, since there was no immediate threat to the students of having to "face" the teacher. The personal touch was not possible to help in dealing with students "sloughing off."

The "problem" students for the most part were seniors, who have traditionally had trouble staying focused in the waning days of their high school careers. But this teacher's experience points up how the traditional teacher's experience in dealing with senioritis is compounded by dealing with it multiple times in multiple sites. He cited the example of Senior Skip day, which he faced three- times: without any warning a large number of students were absent from class. Since DL faculty are not part of the culture at remote sites, they are not attuned to the social and cultural norms of the schools (or clued into the rumor mill) to know of the incidents that will affect instructional time. For the first time, he saw these things inhibiting instruction because of large numbers of student absences (proms, picnics, etc.) which in DL were all multiplied by a factor of 3. To address this problem, he suggested that a way be found to include DL faculty in the day to day life of the remote sites so that DL teachers are made more aware of the social and cultural norms of the sites and can deal with them accordingly.

Content

The BETA teacher doesn't see any difference in the content of subjects taught in DL or Non-DL classes. His teaching style, which is discussion oriented, fits in with the DL classroom. He did indicate that he would like to use cooperative learning groups more in future. He doesn't see why this style of teaching cannot be integrated with DL. The fact that the teacher can't mingle with the groups in the remote site as they are working could be overcome with more interaction with the facilitator in the remote site so that the teacher can rely on that person to help provide the interaction as an extension of the teacher. Such a change would require that the facilitators play more of an instructional role than they do now.

Preparing for Teaching DL

The BETA teacher indicates that DL involves more front-end planning to prepare group work/lessons and to ensure that papers or materials are sent to remote sites. By contrast, working individually with BETA emphasizes continual assessment of educational progress for 30-40 students. He keeps the focus of assessment similar—how much the students show him they have learned. Assessment in his classes is based on homework, tests, projects, and participation in class activities (such as a mock trial which was staged in the Business Law class).

Technology

The teacher indicated that breakdowns of any kind—audio, video—were very infrequent and time spent solving problems was negligible. The BETA administrator sees the biggest problem with DL being the bell schedule. This has had less of an impact on BETA than other schools, since an aide is assigned to every room who can monitor students coming or going to DL classes that don't coincide with their bell schedule.

The weather plays a big part in disrupting DL classes because school districts deal with it on an individual basis, canceling classes or starting them with a one or two hour delay based on how they call it for their district. Last year, for example, most districts in the county exceeded their budgeted snow days. The usual procedure is to shorten vacations or add days at the end of the year to achieve the 180 days of schooling required by state law. During the research year, since inclement weather was not responsible for any school closings, all of the districts had snow day "give backs." Because districts added these unused snow days to their vacation periods, which generally don't coincide anyway, the BETA teacher found that he had many more days with students from one or more sites absent. (In his Economics class, for example, there was a two week stretch where this occurred.) He had to compensate for this lost instructional time by taking some things out of the curriculum he had planned to cover and making adjustments in assignments in other ways.

Administrative support

The administration at BETA views DL very positively and showcases the room when prospective students come to visit. As a result, the teacher thinks he may receive a bit more attention from the administration than other teachers. Its hard to compare on some levels because he is the only teacher who teaches on the system. At the same time, he doesn't feel that his teaching DL has altered his relationship with colleagues.

Recommendations

As noted repeatedly in this report, it takes a long time to develop, implement, refine and stabilize an innovation in education. Research over the last decade suggests that 3 to 5 years is generally required for substantial technology-enhanced innovation. The importance of this can't be overemphasized — to encourage those in the midst to persevere. But we also aim to underscore that innovations aren't simply designed and executed, but must be monitored, nurtured, refined as both the technology, and the

education goals and context change. Distance learning in Dutchess County is still young, and the findings from this research can help to guide modifications in its next stage.

Based on the research, we recommend that the following issues be considered:

1. While the project has thus far been successful in achieving its primary goals of enhancing and restoring content for students, the system is still in a state of tension about some features of the system-wide partnership that is needed to maintain it. Special attention needs to be paid to the problems that appear to be persistent, such as scheduling and planning. Additional problems of coordination that appear less frequently include grades and credit, teacher supervision, school culture. When outside institutions are invited to participate, some of these problems — and likely additional ones — are emphasized. For example, when partnering with a college, problems related to the comparability of grades and credit arise. Review of project structure to resolve such problems and achieve a balance in partnerships is needed as DL moves from implementation to stabilization.

2. Issues of establishing relationships across distances are of primary concern to teachers and students. A second goal for DL was to expand students' social worlds, and this has been less successfully achieved by all accounts than the goals for course content. Participants are especially sensitive to perceptions that they don't really know each other when this knowledge is completely mediated by the technology. Few saw this issue in terms related to changing or enhancing pedagogy or expanding professional expertise, though it could be connected. Some teachers have addressed this by getting classes together at the beginning or end of the semester, and by themselves visiting the remote sites. This issue of relationship needs to be more thoroughly explored, both for the success of the Dutchess County project, and also because any creative solutions will be of value nationally. A combination of strategies for getting classes together physically, for teacher visits, and for experiments with the technologies for both in-class interaction and for more individual interactions outside of classes should be explored.

3. A third goal for the project was to involve the schools in the future of education. The meaning of this is somewhat vague for many, but the sense of being engaged with new strategies for education has supported perseverance through some of the more vexing problems. In light of the success with traditional pedagogy in DL, the project is well-poised to begin to experiment with more innovative uses of the technologies, especially those linked to other desired changes in teaching and learning in the county and the country (e.g. portfolio assessment, project-based learning, collaborative work and so forth). Therefore, experiments in innovative format and pedagogy should be encouraged.

4. Consider carefully the evidence of the low level of student interaction in the classes, both traditional and DL.

5. Teachers would like more opportunities for professional development for DL. While they feel comfortable with the basic operation of the system, and with transferring their familiar teaching style to this context, most would like to learn more advanced instructional techniques for the system, to integrate the supplementary technologies like multimedia, to experiment with innovative pedagogy.

6. The technology functioned very well. Audio remains an irritant on infrequent occasion, and it is necessary to remain vigilant to possible improvements. With respect to refinements, the most frequently heard concerned refinements to the visual components of the system, especially those that may strengthen the nature of relationships across distances. Teachers and students would like, for example, larger and sharper monitors. Experiment with these refinements. Also, students would like larger roles in the operation of the classes and network, and this may be used to advantage to improve the overall flexibility of the system.

7. There is a general perception that these courses are for the most able and motivated students. Consider strategies for broadening student participation, including the kinds of courses offered and the adjustments that may be needed to help them to succeed.

Endnotes

[1] Deal, Terrence E. "Educational Change: Revival Tent, Tinkertoys, Jungle, or Carnival?" in Lieberman, Ann, ed. Rethinking School Improvement: Research, Craft, and Concept. New York: Teachers College Press, 1986, p. 115.

[2] Darling-Hammond, Linda. "Reframing the School Reform Agenda: Developing Capacity for School Tranformation," Phi Delta Kappan. 74 (10): 1992, pp. 753-61. New York: NCREST Reprint Series, 1994, pp 1-18.

[3] Cassidy, S. & Lane C. , "Planned Change and the Adoption of Distance Learning," Distance Learning Resource Network, U. S. Department of Education, p. 1.

[4] Linda Roberts, in Cassidy and Lane, p. 2.

[5] Sheingold, K. & Hadley, M. (1988). Accomplished Teachers: Integrating Computers into Classroom Practice. Special Report: Center for Technology in Education. New York: Center for Children and Technology.

[6] Bank Street College of Education et al. Center for Technology in Education: Final Report 1988-1994. Department of Education #R117 F80011-92.

[7] Two-thirds of the Dutchess teachers (67%) ranked scheduling and bell issues as the highest problem (see Appendix).

[8] Blohm, C. (1995) Software Publishers Association education marketing report: 1994-95 school year. Washington, DC: Software Publishers Association.

[9] Ibid.