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AN EVALUATION OF THE VIRTUAL HIGH SCHOOL AFTER ONE YEAR OF OPERATION

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EXECUTIVE SUMMARY

The Virtual High School (VHS) is a consortium of high schools that offer network-based courses taught by consortium teachers for students in consortium schools. Each school contributes at least one teacher, who teaches a VHS course in place of teaching a section of a regular course at the school. The school also provides a site coordinator who handles administrative matters and supervises local students enrolled in VHS courses. The VHS teachers, with the help of experts, design and offer netcourses over the Internet. Each school in the cooperative can enroll 20 students in these netcourses for each section of a teacher's time (i.e., one netcourse) that it contributes to the pool. The quality of the course offerings is controlled, in part, by requiring each VHS teacher to successfully complete a graduate-level netcourse on the design and development of network-based courses. The netcourse for teachers is intended to provide participants with exposure to appropriate educational strategies and technologies.

Funding for the Virtual High School comes primarily from a 5-year Technology Challenge Grant awarded to Hudson Public Schools in October 1996 by the U.S. Department of Education. The Concord Consortium, a nonprofit educational research and development organization, assisted with the design and implementation of the project. School year 1996-97 was a start-up year for VHS; classes for students were first offered by VHS during the 1997-98 school year.

During school year 1997-98, the Virtual High School offered 29 Internet-based, credit-bearing courses to about 500 students in 27 schools located in 10 states. The VHS evaluation was designed and is being carried out by the Center for Technology in Learning at SRI International, under contract to Hudson Public Schools. This report, which evaluates the first year of the project's implementation, is based on surveys of students, teachers, and administrators, as well as case studies of five participating schools.

Progress toward Meeting Key Goals

The Virtual High School had a successful first year and has made progress toward reaching each of seven key goals established for the project. Major findings for each goal are as follows:

Successful First-Year Implementation

- Despite a rocky start, the VHS project was implemented as planned in its first year. Although teachers felt that they were not able to implement their courses

as planned during the first term, they felt that they were able to do so during the second term. A majority of coordinators, principals, and superintendents agreed that the program was implemented as planned for the 1997-98 school year.

- Large majorities of students, teachers, coordinators, principals, and superintendents expressed overall satisfaction with the project.
- Large majorities of teachers, coordinators, principals, and superintendents said that the project cost more than anticipated but that the additional investment of resources was justified and acceptable and they would spend these resources again, knowing now what was required.

Participants Benefited

- Participation in the project resulted in many benefits to teachers, students, and schools. Teachers acquired new technological skills, new pedagogical and assessment skills, and new content knowledge. They had access to new technology and to technical, subject matter, and curricular experts. They collaborated with other teachers from around the country. Students also acquired new technological skills and had access to new technology.
- The most pronounced benefit of the program was that schools were able to offer, teachers were able to teach, and students were able to take courses that would not have been available otherwise. A majority of coordinators, principals, and superintendents said that their teachers were able to teach courses that they would not have been able to teach otherwise. **All** of the coordinators, principals, and superintendents said that because of VHS, their students were able to take courses that they would not have been able to take otherwise. A large majority of the students said that their course was available to them only through the VHS program, and most listed this fact as a reason for their participation. Finally, large majorities of coordinators, principals, and superintendents said that these courses were important ones.

High-Quality Courses

- Large majorities of students, teachers, and coordinators, and **all** of the principals and superintendents were satisfied with the quality of VHS courses. A large majority of teachers also said that they were satisfied with the challenge and rigor of their VHS courses.

Advantages of Virtual Courses Compared with Traditional Courses

- Although teachers used a variety of pedagogical approaches to involve students (such as cooperative learning, inquiry-based projects, and performance-based assessment), they used these no more often than they did in their regular courses. The exception was the use of student-generated reports, which teachers used more often in VHS courses than in their regular courses.

- Although teachers collaborated **more often** with other teachers in their VHS courses than in their regular courses, they collaborated with parents **less often** in VHS courses. They rarely collaborated with corporate staff, scientists, college students, or seniors in teaching either their VHS courses or their regular courses.
- A majority of students felt that their teachers communicated with them regularly, and a majority of teachers were satisfied with the extent of their communication with students, but teachers were significantly **less satisfied** with communication with students in their VHS courses than in their regular courses. A majority of coordinators also felt that their VHS students interacted **less often** with both teachers and other students in VHS courses than in regular courses.
- A large majority of students felt that they learned a substantial amount in their VHS courses. A large majority of teachers were satisfied with the extent that students were able to grasp concepts in their VHS courses and the extent to which they improved their attitude about the subject matter. A large majority were also satisfied with the amount students learned, but significantly **less so** than they were for students in their regular courses. A majority of coordinators said that their students learned about the same in VHS courses as in regular courses.

A Model for Network Courses

- General levels of satisfaction expressed by teachers, coordinators, principals, and superintendents suggest that VHS is a sustainable model. Most principals and superintendents said they would continue in the project even if there were no outside funds to support their participation.

Equitable Benefits

- Participating schools are representative of schools across the country in the amount of funds spent per pupil and on demographic indicators.
- In contrast, VHS students were not representative of the student body within participating schools. A majority of coordinators said that VHS students did **not** come from the full range of socioeconomic backgrounds present in their schools but came from relatively affluent backgrounds. A large majority said that VHS students had above-average or exceptional academic backgrounds and were college bound.

High-Quality Professional Development for VHS Teachers

- Most of the VHS teachers responded positively about the Teachers Learning Conference (TLC), a graduate-level netcourse that constitutes the primary teacher professional development activity of the project. A majority of the teachers felt that the TLC was effective in preparing them to plan and implement a VHS course. Similarly, most felt that the course was effective in preparing them to use technology in their teaching. The coordinators agreed; a very large

percentage of them felt that teachers were effective in their use of computers and networking in teaching.

Key Issues

The experience of the VHS project during its first year of operation suggests that there are a number of important issues to focus on during the coming years:

- **Course quality.** Currently, administrators assume that VHS courses are of high quality, but ultimately it is likely that VHS will need additional procedures to help assure this quality in some way. The VHS staff may need to establish standard criteria and/or procedures for reviewing the quality of course offerings. This documentation can be used, in turn, by participating school districts to aid them in satisfying state and local course quality requirements.
- **Pedagogy in VHS courses.** Students and teachers were satisfied with the amount of communication in VHS courses, and they reported that students learned as a result of their VHS course participation. However, they reported that both communication and learning were higher in their regular courses. Additional research is needed to examine the most effective patterns of communication within VHS courses and to document directly the impact of the VHS experience on student learning.
- **The power of networked technology.** Currently, VHS teachers are using the power of networked computers to collaborate with other teachers, content experts, curriculum experts, and technical experts. However, this collaboration with outside resources has not yet been extended to students. New applications of the technology need to be explored and used that can increase the impact of the project and support educational reform.
- **The range of students served.** The current VHS curriculum is dominated by advanced courses that cater to students who are successful, independent, and college bound. Although this is an important service for those who are participating in the program, this focus limits the impact of the project to a narrow, homogeneous range of students. By creating and offering additional models of course offerings and instructional arrangements, VHS could significantly increase the diversity of its student body and broaden its impact.
- **Sustainability and scaling up.** The VHS program requires more time and resources than were expected by teachers and administrators. Even though administrators feel that these additional expenses are justified, there are limitations on the extent to which participating schools will continue after external funding is discontinued. VHS staff need to explore ways of reducing costs and increasing impact to assure sustainability and scalability of the project. Of particular concern are the added expense of the site coordinator and the relatively low enrollment in VHS courses.

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I. INTRODUCTION

The use of information technologies in schools has become an important part of educational policy in the United States, in part because there is relatively little use of computers and other information technologies in the nation's schools. As a Department of Education report (1996) notes, U.S. students make minimal use of new technologies for learning, typically employing them for only a few minutes a day. Yet, computers and other technologies have transformed nearly every aspect of American life. Computers and information technologies are changing the way Americans work and play, increasing productivity, and creating entirely new ways of doing things. The equitable availability of computers and the knowledge to use them are often seen as important parts of preparing U.S. children for high-wage, high-skill jobs in an increasingly competitive world marketplace.

In 1997, the President's Committee of Advisors on Science and Technology (PCAST) recommended a significant increase in the use of information technology in U.S. schools. The committee presented a vision of educational technology in which computers would be integrated into and improve the quality of all school subject areas. In this vision, teachers would be provided with ongoing mentoring, consultative support, and the time required to familiarize themselves with technology and incorporate it into their lesson plans. Computer and networking technology would be available to all students, regardless of socioeconomic status, race, ethnicity, gender, or geography. This technology would be used in conjunction with educational reform efforts and pedagogical methods to develop higher-order reasoning and problem-solving skills. Funding would be available to support the acquisition of hardware, software, and support and for the significant research effort needed to establish the impact of these resources on the educational enterprise.

The promise is that the power of information technology will contribute to the reform of education and the improvement of teaching and learning. Computers can contribute to constructivist, project-oriented pedagogical practices that promote higher-order skills, such as design, composition, and analysis, and more basic skills, such as the mechanics of writing (Means & Olson, 1995). Networked computers can support changes in the organization of the class or the structure of the school day (Harasim, Hiltz, Teles, & Turoff, 1995; Hiltz, 1995). The kinds of changes that these authors envision with networked learning include:

- Mentorships in which distant volunteers would tutor or interact with students on-line.
- Visiting experts who can share their expertise with students.
- Collaborative activities in which students from different schools, perhaps even different complementary courses, work together on a project.
- Role plays or simulations, in which students become historical figures or different countries and interact around some shared task or goal.
- International pen pals, where students exchange ideas or assignments with students in different countries.
- The sharing of locally collected data (e.g., on water or air quality), in which students look for patterns or trends across locations.

This report examines the impact of one such effort to apply the capabilities of networked technology for the improvement of education in high schools across the country. We examine the first year of implementation of the Virtual High School project.

The Virtual High School Project

Within the emerging federal effort to support the use of information technology for the improvement of U.S. education, the Technology Innovation Challenge Grant Program was established in 1995. Among the recipients in the second round of funding of this program was the Virtual High School (VHS) project. This is a report of an evaluation of the first year of operation of this project.

The Virtual High School is a consortium of high schools that offer network-based courses (netcourses) taught by consortium teachers for students in consortium schools. Each school contributes at least one teacher, who teaches a VHS course in place of teaching a section of a regular course at the school. Teachers in the VHS pool, with the help of experts, design and offer netcourses over the Internet. Each school in the cooperative can enroll 20 students in these netcourses for each section of a teacher's time (i.e., one netcourse) that it contributes to the pool. The quality of the course offerings is controlled, in part, by requiring each VHS teacher to successfully complete the Teachers Learning Conference (TLC), a graduate-level netcourse on the design and development of network-based courses. This netcourse for teachers is intended to provide participants with exposure to appropriate educational strategies and technologies.

Funding for the Virtual High School comes primarily from a 5-year Technology Challenge Grant awarded to Hudson Public Schools in October 1996 by the U.S. Department of Education. The principal investigators for the VHS consortium are Dr.

Sheldon Berman, Superintendent of the Hudson, Massachusetts, Public Schools, and Dr. Robert Tinker, President of the Concord Consortium, a nonprofit educational research and development organization. School year 1996-97 was a start-up year for VHS; classes for students were first offered by VHS during the 1997-98 school year.

During school year 1997-98, the Virtual High School offered 29 Internet-based, credit-bearing courses to about 500 students in 27 schools located in 10 states.¹ Additional information describing the operation of the Virtual High School can be found in Chapter II. The VHS evaluation was designed and is being carried out by the Center for Technology in Learning at SRI International, under contract to Hudson Public Schools.

Evaluation of the Virtual High School

A preliminary evaluation plan was prepared by SRI International and became part of the VHS proposal to the Challenge Grant program. Work on the evaluation began shortly after the VHS grant was awarded in October 1996. The primary goals of the evaluation are to document VHS activities, assess the impacts of the project, and identify lessons learned as a result of its implementation.

A clear understanding of the project's goals is essential to the evaluation; in fact, measuring progress toward reaching those goals is one of the foundations of this report. The grant proposal submitted in 1996 to the Challenge Grant program identifies one overarching goal for the VHS consortium:

to create a national consortium of schools that expands members' curricular offerings through a wide range of excellent, current, innovative network-based courses that support reform. This can be done in a way that is scalable and can continue post-funding, while spawning independent, parallel efforts.

SRI staff reviewed this overarching goal and all the other goals and objectives set out by VHS in its grant proposal and then worked with VHS staff, and other members of the consortium, to clarify and elaborate a set of goals that would be both comprehensive and relatively concise. The result is a list of seven goals for the Virtual High School that has helped to guide data collection, analysis, and reporting (see Exhibit 1). For example, Chapter III of this report ("How Well Is VHS Meeting Its Goals?") describes the project's progress toward reaching each of the goals identified in Exhibit 1.

¹ This count does not include three schools in Alaska that did not offer VHS courses and that also had very small enrollments of VHS students. VHS has plans to include more schools in later years.

SRI staff evaluated the project against these goals during its first year of implementation. Because this is the project's first implementation year, the report focuses on the structure and development of the project. Reports on the subsequent years of the project may focus on other aspects and issues.

Data Sources

The evaluation draws on multiple data sources, including surveys, case studies, interviews with consortium staff, and document reviews. The primary data sources are surveys of participants and case studies of selected schools.

Surveys. Through June 1998, 11 surveys of VHS participants were conducted. SRI designed and conducted a baseline survey of VHS teachers in the spring of 1997. Baseline surveys of the VHS coordinators (located in each participating school), school principals, and district superintendents were carried out in the fall of 1997. In the spring of 1998, near the end of the first full year of VHS operation, members of each of these four groups provided additional information through a second set of mail surveys. The response rate on each of these eight surveys was at least 85%.

In addition, the VHS central staff conducted on-line surveys of VHS students at the end of the first and second semesters. This report incorporates key data from the second-semester student survey, which had a response rate of 80%.

Finally, VHS staff surveyed participants in the first professional development netcourse for prospective VHS teachers, which operated during the spring and summer of 1997. Data from that survey, which had a relatively low response rate, are not used in this report.

Exhibit 1

PRIMARY GOALS FOR THE VIRTUAL HIGH SCHOOL CONSORTIUM

1. The practical problems of establishing and managing the Virtual High School will be solved, demonstrating that the approach is feasible for many schools.
2. Students, teachers, schools, and districts will benefit from participating in VHS courses.
3. Courses offered through VHS will be of high quality and will support reform efforts aimed at raising education standards (e.g., VHS students will become more engaged in course work and take more responsibility for their own learning; greater attention will be given to teaching for understanding).
4. Internet-based VHS courses will demonstrate some advantages (e.g., an expanded community, new kinds of courses, technology skills for students), compared to traditional courses.
5. The VHS project will become a model of how to use the Internet to deliver high school courses.
6. VHS benefits will be made available to students equitably.
7. The network-based professional development provided to participating netcourse teachers will be of high quality and will make an important contribution to the quality of the netcourses offered to students.

Case studies. Five schools, distributed across regions and school types (e.g., urban and rural, more and less wealthy, etc.) were selected as case study sites. (See Appendix A for characteristics of the five schools.) During VHS's first year of operation, each of these schools was visited twice, once in fall 1997 and once in spring 1998. At each institution, SRI interviewed teachers who were teaching a netcourse for students, the school's VHS coordinator, the school principal, and others, as appropriate. The district superintendent for each school was also interviewed. In addition, focus group sessions were conducted with a number of students in each school who were taking netcourses offered by other participating schools. On the basis of the information gathered about each school, each site visitor prepared a written case study about 15 pages long describing the school's experiences with VHS. A lengthy cross-case analysis organized around the VHS goals was then produced during the spring of 1998. Information from all the case studies and from the cross-case analysis was used in preparing this report.

Organization of This Report

Following this introduction, there are three other chapters. Chapter II provides a more elaborated description of the Virtual High School than the one provided above. For readers unfamiliar with VHS, Chapter II, although it is not strictly “evaluative” in its approach, is probably essential reading.

Chapter III is organized around the seven goals for VHS that were identified above. The chapter presents information to answer the question “How well is VHS meeting its goals?”

Chapter IV is organized around five key issues that VHS is trying to address, issues that may affect the long-term impact of the project. The chapter also offers tentative conclusions and recommendations based on VHS’s first year of operation.

Appendix A includes a detailed description of the methodology for the evaluation. Separate appendices include complete copies of each of the surveys and summary descriptions of the case studies.

II. THE VIRTUAL HIGH SCHOOL IN OPERATION

This chapter describes the Virtual High School in more detail. The first section positions the VHS project in the broader context of a range of approaches to distance learning. The structure of the VHS project is discussed in the second section. The third describes preparations that were needed to begin operating the VHS project. The fourth section describes LearningSpace™, the software system that supports the VHS project. The fifth describes the courses offered by VHS in its first operational year. The final section characterizes the schools, teachers, and students that participated in the project during the 1997-98 school year, the first year of the project's implementation.

Distance Learning and the Virtual High School

According to the Technology Challenge Grant proposal, the Virtual High School was established to develop and offer a wide range of high-quality, innovative netcourses that take full advantage of the Internet and support educational reform:

By bringing the world into schools, Internet courses can tap knowledge and experience of corporations, universities, and individuals anywhere. Schools exploiting these resources can accelerate students' advanced study and integration into work and society while providing academic support as they make the transition to work. (p. 1)

To accomplish this goal, the project posts course materials on the VHS Internet server, which students can access at any time, and provides a conferencing system that allows students and teachers to exchange asynchronous communications. This approach to distance learning can be positioned in a four-square map of options for collaborative technologies (McIsaac & Gunawardena, 1996; Johansen et al., 1991). This framework crosses time and place to form a two-by-two matrix of distance education technologies: same time/same place, same time/different place, different time/same place, and different time/different place. The VHS project falls in the different time/different place square. That is, teachers and students can work together even though they are signed onto the system from different places and at different times. This framework distinguishes the VHS project from other distance learning approaches, such as audio teleconferencing or interactive video, that assume participants are interacting from different places at the same time. A key feature of this approach is the ability to support many-to-many interactive communication; that is, teachers can interact with their students and students can interact with each other to collaborate on projects, discuss topics, and debate issues.

In a survey of teachers that have used this approach (Harasim & Yung, 1993), 90% of the respondents said that it supports a different way of teaching. They noted:

- The role of the teacher changes to that of facilitator and mentor.
- Students become active participants; discussions become more detailed and deeper.
- Access to resources is expanded significantly.
- Learners become more independent.
- Access to teachers becomes equal and direct.
- Interactions among teachers are increased significantly.
- Education becomes learner centered; learning becomes self-paced.
- Learning opportunities for all students are more equal; learner-learner group interactions are significantly increased.
- Teaching and learning are collaborative.

The results of the Harasim and Yung study suggest that the VHS project's approach to distance learning can both provide participating schools with new course offerings and support educational reform. This prospect is addressed by the findings of this report.

Structure of VHS

The Virtual High School is virtual in several senses. As mentioned above, the courses are virtual; all the courses are offered entirely on the Web. But VHS is virtual in a more structural sense, as well. The structures normally associated with a school are also virtual; the faculty, the student body, the administration, and the school itself are all distributed organizations, which do not exist in one location in the physical world.

The faculty is composed of teachers employed by participating school systems all across the country. These teachers designed and offered their VHS courses in addition to their regular courses, which they teach in physical classrooms as part of the curriculum in their home school districts. Participating schools agreed to release teachers from teaching one section of a regular course, allowing them to substitute the teaching of a VHS netcourse. As part of their participation in the project, VHS teachers also took a graduate-level on-line professional development course, the Teachers Learning Conference, that helped them design and prepare their course offerings. As part of their participation in the TLC, teachers interacted on-line with VHS staff and each other about pedagogical reform and issues related to the design and offering of virtual courses. With

the exception of a meeting in the Boston area in the fall of 1997, the teachers have not met face-to-face with others outside their immediate area.

In return for offering a virtual course, the teacher's home school was able to enroll as many as 20 of its students in any of the VHS course offerings. The student body there was virtual. Participating students usually enrolled in only one VHS course at a time. This means that most of their courses were in a "regular" format (i.e., traditional, face-to-face courses offered by their high schools), while one was different—a "virtual" course. In their virtual course, they used the VHS software to interact with teachers and other students in the course, but (with a few exceptions) they never met teachers or students face-to-face. There was a VHS teacher in their school, but that teacher was teaching a different course than the one in which students were enrolled; it was very rare for students to enroll in a virtual course that was offered by the teacher in their school.

Face-to-face contact between VHS students and VHS staff was provided by the site coordinator. As part of participation in the project, each school provided not only a teacher and course but a site coordinator, as well. The site coordinator helped the VHS students with their courses and concerns about the project, and helped manage the VHS project in other ways (this role will be discussed in more detail in Chapters III and IV). Schools received funds from the VHS grant to release 20% of a teacher's (or administrator's) time to act as the VHS site coordinator. By design, the site coordinator was to focus on management and oversight, not teaching a VHS course; thus, only in very rare cases was the site coordinator also a VHS teacher. Whereas the VHS students within a participating school (who might be enrolled in a dozen different VHS courses) were the primary focus of attention for the VHS site coordinator, the VHS teacher at that school was focused primarily on the VHS students enrolled in his or her VHS course, and those students were almost always located in different schools than the teacher's.

Finally, the VHS administration is also virtual. Those people in charge of recruiting participating schools, supervising the faculty, organizing the course offerings, and maintaining the software are located at two organizations in Massachusetts: Hudson School District and the Concord Consortium (<http://www.concord.org>). Yet, with the exception of the two courses offered by Hudson, all the teachers are located elsewhere.

VHS Central Staff

Although the two principal investigators for the Virtual High School, Dr. Sheldon Berman and Dr. Robert Tinker, do not spend full-time on this project, each has designated

a member of his staff who acts as a full-time administrator. Bruce Droste is located at the Concord Consortium, and Elizabeth Pape is located at Hudson Public Schools. These are probably the two VHS staff members who interact most often with site coordinators, teachers, media, and the public.

In turn, each of the VHS administrators is assisted by other staff. Together, the responsibilities of the VHS central staff have been highly varied. During the first 2 years of the project (1996-98), they included the following (an illustrative list):

- Recruiting schools and teachers to participate in VHS.
- Establishing procedures and schedules for the operation of VHS, including managing centrally the enrollment of students in particular netcourses.
- Establishing minimum technical requirements for equipment in VHS schools.
- Helping to design and teach several professional development netcourses for prospective VHS teachers.
- Setting up and maintaining the servers on which the VHS courses reside.
- Answering technical, substantive, and procedural questions from participants.
- Convening meetings of all VHS teachers (fall 1997) and all VHS coordinators (spring 1998) to discuss progress of the project and key issues.
- Conducting surveys of students enrolled in VHS courses and responding to issues raised by the surveys.
- Working with Lotus and other corporate sponsors, as well as with the U.S. Department of Education, the major funding organization.

Quality Control, Credits, and Course Grades

Overall responsibility for the operation and quality of the Virtual High School clearly rests with the principal investigators and the central VHS staff. During 1997-98, the responsibility for the nature and quality of each VHS course rested primarily with the teacher (or teachers) who developed the course, although, as has been mentioned, VHS staff provided oversight and assistance, as needed. The teachers were also responsible for grading their VHS students. However, it was the consortium schools that awarded credit to students for successful completion of the VHS courses.

Because teachers were almost always located in a different school than their VHS students, and because in many cases they were in different states, the issues that arose regarding credit, grading, and the nature of the VHS courses are interesting ones. These issues are discussed at greater length in Chapters III and IV.

Preparations for Operating the Virtual High School

As mentioned in Chapter I, the first year of the VHS project was spent getting ready for students to participate in netcourses at the beginning of the 1997-98 school year. This was a big job, requiring the recruitment of schools, the training of teachers, the design of netcourses, a commitment to particular types of technologies and course delivery systems (e.g., LearningSpace), accommodation to extraordinarily varied school schedules across 10 states, the development of uniform rules and procedures, publication of several course catalogs, the management of course selections and the enrollment of hundreds of students in netcourses, and many other tasks. Documenting the process of starting up the Virtual High School is a task beyond the scope of this report. However, it may be useful to describe a few of these tasks here, particularly to alert any organizations interested in starting their own virtual school about the types of issues they may face.

Agreements with Schools and Distribution of Funds

VHS staff found that many high schools were interested in participating in the project. According to the principals and district superintendents, the two most attractive features of VHS were the capability that it offered them to quickly expand course offerings beyond what was feasible for individual schools and the appeal of using computer and network technologies in a way that seemed to offer important benefits to their students and teachers. In addition, a number of principals and superintendents discovered that VHS was extremely appealing to their school boards, which made it relatively easy to get any necessary board approvals, including (in some cases) additional funds for technology expenditures.

Preparation of Teachers and Development of Courses

Before being selected for participation, each school had to identify the title of a course that it would offer and the name of a teacher who would teach the course. As mentioned earlier, each prospective teacher was required to participate in a graduate-level professional development netcourse focusing on how to create and teach a netcourse for high school students. The first of these netcourses for teachers began operating in March 1997 and included 31 prospective VHS teachers. Part of the work of the netcourse was to prepare a syllabus and at least some of the materials that would be used in teaching the course to students. A variety of content experts, technology experts, and experts in Internet-based work were tapped to teach the teachers. More information about the success of these courses is included in Chapter III, under Goal 7.

Course Selection by Students

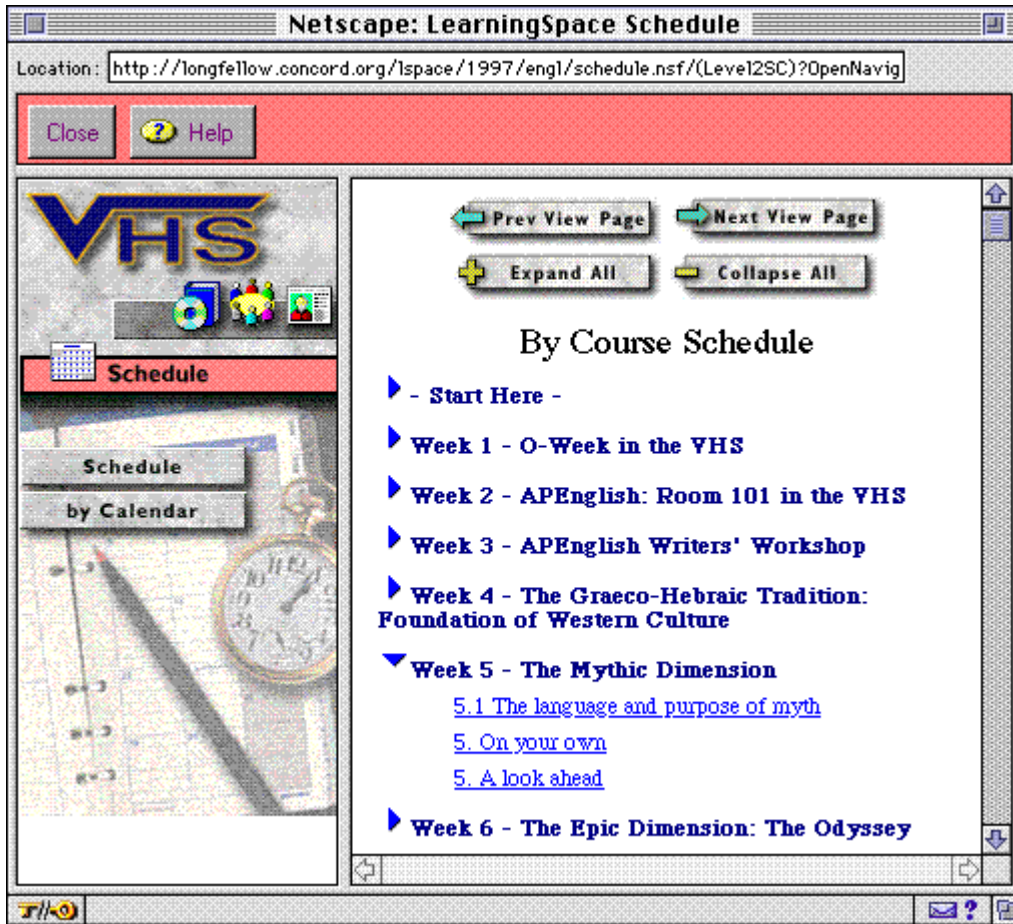
One of the challenges faced by VHS was to have descriptions of the netcourses available to students in time for the virtual courses to be included as part of high schools' normal course sign-up procedures for their students. This process took place in the spring of 1997. Nearly half of the VHS students (47%) reported in spring 1998 that they had selected their spring VHS course a full year earlier, when they selected their regular courses for academic year 1997-98. Another 10% of students also selected their VHS course in the spring of 1997, but somewhat after the time when they selected their regular courses. The remaining 43% of the students selected their spring VHS course at later dates (including 16% who added the course during the spring 1998 add/drop period for VHS courses).

Software Environment: LearningSpace™

Each participating school provided its VHS students with access to the Internet on computers located in the school. Using any Web browser software (such as Netscape or Internet Explorer), students use a password to log into the particular VHS course in which they are enrolled, typically logging in and participating in the class several times a week (as well as completing work off-line). With the browser, the students are able to view, print, and respond to materials already "posted" on the course's Web site by the teacher or by other students. In some courses, links are also provided to other, related Internet sites where pertinent materials can be found.

Although students can use a common browser to access VHS courses, the courses were developed and are electronically delivered through a proprietary technology called LearningSpace. The software is distributed by Lotus, a partner with Hudson Schools and the Concord Consortium in the VHS Technology Innovation Challenge Grant proposal. LearningSpace consists of five interactive databases and tools for teachers to create and deliver on-line courses. The databases correspond to virtual areas of LearningSpace accessible to students through their Web browsers: the Schedule, Profiles of students and teachers, a Media Center, the CourseRoom, and an Assessment area. A sample view of one of these areas from one of the netcourses is shown in Exhibit 2.

Exhibit 2
A SAMPLE VIEW FROM LEARNINGSPLACE



The Schedule displays the dates for topics, assignments, and tests. The Profiles provide brief descriptions and, sometimes, photos of teachers and students. The Media Center contains readings and other digital resources associated with topics and assignments. The CourseRoom provides a space for threaded conversations about teacher- and student-supplied topics. The VHS courses are designed to be asynchronous, allowing teachers and students to log in and participate whenever they want to do so. (In fact, a large fraction of students access their courses from home computers, as well as from school.) There is currently no provision in VHS courses for synchronous activities, such as take place in Internet-based “chat rooms.”

Although students do not need any special software to access courses developed with LearningSpace, they do need to learn how to use it (e.g., how to send their assignments through the Internet, participate in student discussions, etc.). Beginning in the spring 1989 semester, VHS central staff required that all the VHS netcourses begin with a week-long unit for students on how to work with LearningSpace. A short handbook for students was also made available through the Web.

Special LearningSpace software housed on each teacher’s computer and on the Internet servers maintained by the Concord Consortium provides a standardized environment in which the on-line course materials, schedules, assignments, discussions, and other documents are organized and viewed. Each teacher was responsible for the design of his or her netcourse using LearningSpace, with assistance provided by VHS central staff, as needed. For the most part, the content for the course was stored in the LearningSpace Media Center. In some cases, the teachers arranged with VHS central staff that the participating students would receive a packet of materials in the mail before the course began. For example, students in the Hands-on Physics, Introduction to Stellar Astronomy, and other science courses received laboratory materials that would later be used to complete course assignments.

VHS Courses

A list of the 29 netcourses offered during the 1997-98 school year is shown in Exhibit 3. During the 1997-98 school year, nearly all VHS courses were one

Exhibit 3
VHS Courses and Enrollments During School Year 1997-98

Course Title	Originating School	Fall '97 Enrollment*	Spring '98 Enrollment*
A Model United Nations Simulation Using the Internet	Algonquin High School, Northborough, MA	10	9
AP English: A Web-Based College Level Course in Literature & Composition	Forks High School, Forks, WA	13 (term 1)	12 (term 2)
AP Statistics	Collingswood High School, Collingswood, NJ	15	13
The Bioethics Symposium	Hoover High School, North Canton, OH Wickliffe High School, Wickliffe, OH Westborough High School, Westborough, MA	15	12
Business in the 21st Century	Northampton High School, Gaston, NC	12	15
Computer Technology I	New Hanover High School, Wilmington, NC	16	18
Creative Problem Solving in Math & Logic	Hudson High School, Hudson, MA	13	16
Current Issues in Nutrition and Health	Framingham (MA) State College **	--	12
Earth 2525: A Time Traveler's Guide to Planet Earth	Allen High School, Allen, TX	11	14
Eastern and Western Thought - A Comparison	Campolindo High School, Moraga, CA	13	15
Explorando Varios Aspectos de Culturas Hispanas Através del Internet	Allen High School, Allen, TX	7	8
The Folklore and Literature of Myth, Magic, and Ritual	Shrewsbury High School, Shrewsbury, MA	11	20
Global Lab	Mendocino High School, Mendocino, CA Strath Haven High School, Wallingford, PA	8 (term 1)	9 (term 2)
Hands-on Physics	Concord Consortium, Concord, MA **	13	6
Informal Geometry: A Construction Approach	Lumberton Senior High, Lumberton, NC	6	9
Integrated Ecospheric Systems	Myers Park High School, Charlotte, NC	11	12

* Enrollments are based on the numbers of students who completed each course and were assigned a grade.

** These institutions are not high schools but did offer a VHS course.

Exhibit 3
VHS Courses and Enrollments During School Year 1997-98 (concluded)

Course Title	Originating School	Fall '97 Enrollment	Spring '98 Enrollment
Introduction to Computer Programming	Hillside High School, Durham, NC	35	31
Introduction to Microbiology	Center High School, Center, CO	19	17
Introduction to Stellar Astronomy	Hudson High School, Hudson, MA	13	14
La Connection Francophone	Acalanes High School, Lafayette, CA	4	5
Music Appreciation and Composition	Westborough High School, Westborough, MA	16	15
The Native American Experience	Marlborough High School, Marlborough, MA	8	9
Poetics and Poetry for Publication	John F. Kennedy High School, Fremont, CA	16	17
Regional Literature of the United States (2nd semester title: Exploring America Through Its Writers)	Windsor High School, Windsor, CA	2	5
Russian, Soviet, and Post-Soviet Studies	Miramonte High School, Orinda, CA	8	12
Space Based Astronomy	Keystone Oaks High School, Pittsburgh, PA	10	11
Washington, DC: American National Government and Politics Simulation (2nd semester title: United States Government Issues)	Escalante High School, Tierra Amarilla, NM	13	9
Writing: From Inner Space to Cyber Space	Rutgers Preparatory Upper School, Somerset, NJ	7	13
Writing Through Hypertext	Las Lomas High School, Walnut Creek, CA	12	15
TOTAL VHS ENROLLMENT		337	373
MEAN CLASS SIZE		12.0	12.9

* Enrollments are based on the numbers of students who completed each course and were assigned a grade.

** These institutions are not high schools but did offer a VHS course.

semester long; only 2 of the 29 VHS netcourses were year-long courses. By design, all the semester-length netcourses were offered twice, once in the fall and again in the spring—except for one that was offered only in the spring. Total enrollment in VHS courses was 337 in the fall semester and 373 in the spring semester. Most students enrolled in a VHS course in both semesters; however, some students took only a single, semester-long course. Thus, the total number of students who completed any VHS course during the school year was about 503.

Two netcourses (The Bioethics Symposium and Global Lab) were team taught, with teachers from more than one school cooperating to prepare the curriculum and teach the course. In the case of The Bioethics Symposium, the teachers came from three schools. (The Music Appreciation and Composition course also had a second teacher, from the Concord Consortium, who acted as an “assistant instructor.”) The capability to cooperate with another teacher, or other individuals, hundreds or thousands of miles away is a distinctive feature of courses offered via the Internet. Whereas co-teaching arrangements were unusual in VHS courses during 1997-98, the participation in a single course of students who were located in many different states was the norm.

As can be seen from Exhibit 3, the subject matter of VHS courses ranged from what can be found in many existing high school course catalogs (such as AP English, AP Statistics, and Introduction to Computer Programming) to unusual, if not unique, offerings (such as Russian, Soviet, and Post-Soviet Studies, The Bioethics Symposium, and a course exploring Hispanic culture through the Internet). The expanded variety of course offerings made possible by VHS turned out to be one of its most appealing features.

The preceding text provides a brief overview of the Virtual High School courses. More information on this topic will be provided in the remainder of the report. In the next section, information is provided about the VHS participants.

Virtual High School Participants

The VHS staff intentionally sought a varied group of schools to participate in the project during its first year of operation. This section provides information about the participating schools and districts, the VHS teachers, and the VHS students.

Participating VHS Schools and Districts

Principals (27) and superintendents (23) were asked to provide information describing the schools and districts in which VHS operated during the 1997-98 school year. Their responses show that VHS is, in fact, operating in a very varied set of schools.

The average high school enrollment was 957 students. This is higher than the U.S. average (about 700), probably because few small rural schools participated in VHS.² However, there was a wide variation in school size, with 24% of the schools enrolling 500 students or fewer and 33% enrolling more than 1,200 students.

Reported per-pupil expenditures, according to the superintendents, averaged about \$5,700 for all schools in their districts. That figure is very close to the national average of more than \$5,800 (“current expenditures per pupil”). The VHS schools thus appear to be only very slightly “poorer,” on average, than the typical U.S. school. There was a wide variation in per-pupil expenditures, however, with some VHS schools and districts reporting per-pupil expenditures of \$9,000 or more.

Principals reported that, on average, 18% of the students in their schools received free or reduced-price lunches. This compares with 22% in secondary schools nationally. The superintendents reported a comparable district average figure of 29%, which compares with 33% nationally for all school districts. Again, the averages mask the fact that there was a wide variation, with 21% of the principals reporting almost no students participating in the school’s free/reduced-price lunch program, while 25% reported that more than one-fourth of the students participated.

The average proportion of nonwhite students in the VHS high schools was 29%, according to the principals. For all schools in the districts participating in VHS, the corresponding figure was 30%, according to the superintendents. These figures are close to the national average of 34% nonwhite students. A number of the VHS schools, 17%, had an enrollment of more than 50% nonwhite students; in slightly more than a third of the schools, white students made up 90% or more of the enrollment.

During 1997-98, VHS schools (and therefore VHS teachers and VHS students) were located in 10 different states. All the schools except one were public schools.

² All national data in this report are taken from the *Digest of Education Statistics, 1996*, unless otherwise noted.

VHS Teachers

The baseline survey of VHS teachers was conducted to gather background information about the teachers. Some of these data can be compared with data about all teachers in the United States teaching in grades 8 to 12,³ to better understand who taught VHS netcourses during the 1997-98 school year.

Experience. In general, teachers participating in the Virtual High School project were experienced practitioners. For example:

- The cumulative full-time experience of VHS teachers was almost 16 years, very similar to that of the national sample.
- About seven out of eight of VHS teachers (87%) were teaching full-time at their current school, similar to the proportion of teachers in the national sample (93%).
- VHS teachers averaged almost 11 years tenure at their current school, only a half-year more than the national sample. However, a greater percentage of VHS teachers (25%) than those in the national sample (16%) had been at their current school for more than 20 years.

An overwhelming majority of VHS teachers (90%) had designed a new course before their involvement with VHS. In addition, 85% felt that their professional training had left them “somewhat prepared” or “very prepared” for creating new courses.

Race, gender, and age. The VHS teachers in 1997-98 were ethnically homogeneous; 96% of them were Caucasian. Fifty-two percent of the teachers were female, and the vast majority of participants were between the ages of 30 and 49.

Education. The Virtual High School teachers were well educated. A majority (69%) held master’s degrees, compared with an average of 50% in the national sample. Only about 20% of the teachers majored in education, compared with 73% nationally. The VHS teachers seem highly qualified in the fields of their major teaching assignments; for example, 97% were certified in the field of their main teaching assignment.

Teaching responsibilities. The teaching load for VHS teachers was an average of 4.5 classes per week, slightly lower than the national average of 5.1 classes per week. VHS teachers were more concentrated at the upper high school level than the national

³ National data are drawn from the Schools and Staffing Survey conducted by the National Center for Education Statistics during school year 1993-94 (NCES, 1995). The large sample used in that survey (tens of thousands of teachers) was statistically representative of all of the nation’s public school teachers.

sample: 70% of VHS teachers taught 10th graders, 80% 11th, and 77% 12th, compared with 59%, 60%, and 59%, respectively, in the national sample.

In the spring of 1997 (before teaching a VHS course), the teachers taught a total of 128 separate classes, 29 of which (23%) were honors classes. Seventeen VHS teachers (57%) taught at least one honors class, and 13 (43%) taught no honors classes.

Although all VHS teachers were very satisfied or somewhat satisfied with the regular (non-VHS) courses that they taught, the data show some interesting differences between teachers of honors classes and other teachers. For example, more teachers with at least one honors class tended to use inquiry-based projects, performance-based assessments, and shared electronic reports than those who taught no honors classes. However, the vast majority (92%) of VHS teachers with no honors classes reported connecting school learning with work experience or real-world situations, whereas only 53% of those with at least one honors class did so. Among VHS teachers with at least one honors class, 65% collaborated with other teachers, compared with only 39% of those who did not teach honors classes. On all dimensions, teachers with no honors classes were more satisfied with the courses they taught than were those who taught at least one honors class.

Computer use. Before teaching a VHS course, half of the teachers already used their computers daily, and no teacher reported rarely or never using a computer. The majority of the teachers were satisfied with the effectiveness of their computer use. However, it would by no means be accurate to say that most of the VHS teachers were computer experts. Their experience and expertise varied a great deal.

The VHS Students

Students enrolled in VHS courses in the spring of 1997-98 were predominantly high school seniors (58%) and juniors (34%). Only 8% of the VHS students were in the 8th, 9th, or 10th grade. Fifty-two percent of the VHS students were males, and 48% percent were females. The great majority of VHS students (85%) intended to go to a 4-year college after graduation. This figure is considerably higher than the proportion of students nationwide who attend a 4-year college immediately after graduating (about 30%).

There was a great variety in the number of courses in which these students were enrolled (counting both regular and VHS courses). The average was a total of 5.5 courses, but the range extended from 3 to more than 8.

III. HOW WELL IS VHS MEETING ITS GOALS?

As noted in Chapter I, SRI evaluators worked with VHS project staff at Hudson and Concord and with participating teachers and administrators early in the project to clarify the goals that would guide the project and be used to assess its impact (see Exhibit 1). These goals serve as the basis for the project's evaluation. In this section, the findings from end-of-year and baseline surveys and from the cross-case analysis of end-of-year and baseline case studies are analyzed in relationship to these goals.

Goal 1. Implementation Problems Will Be Solved

The first goal of the project is to solve the practical difficulties involved in establishing and managing a large-scale national effort. Clearly, this was the most important goal for the first years of the project's implementation. VHS is a complex and novel project. As mentioned in Chapter II, project implementation required collaboration with schools in 27 districts, in 10 states from Massachusetts to California and from Washington State to Texas. Twenty-seven site coordinators were identified, 31 teachers were trained, 30 new courses were designed, and 29 were offered with more than 700 enrollments over two semesters. This was a major accomplishment.

General Satisfaction

An important indication of successful implementation is the level of satisfaction expressed by the various participants in the project at the end of the year. A large majority of the participants expressed satisfaction with VHS's first school year; students, teachers, coordinators, principals, and superintendents all expressed satisfaction with the project. Students gave a mean rating of 1.9 (on a 4-point scale, "1" meaning "strongly agree" and "4" meaning "strongly disagree") to the statement "My participation in a VHS online course was a valuable learning experience;" 84% either agreed (48%) or strongly agreed (36%) with this statement. A majority of the students (72%) said they would take another VHS course if they could, and 81% said they would recommend the VHS experience to other students.

At the end of the spring semester, 93% of teachers were either very satisfied (24%) or somewhat satisfied (69%) with the VHS project. A large majority of the teachers (89%) said they would be willing to get involved in VHS knowing what they now knew about it. This finding is consistent with teacher comments during field site visits. All the participating teachers at the case study schools were supportive. As one teacher put it, "I

love it! I just love it.” All the case study teachers decided that they were going to teach a VHS course again. Similarly, 96% of the coordinators were either very satisfied (36%) or somewhat satisfied (59%) with the VHS project.⁴

Among administrators, 91% of the principals were either very satisfied (32%) or somewhat satisfied (59%) with the VHS project. Indeed, 78% said they would continue in the project even if there were no outside funds to support their participation. All 21 of the superintendents who responded were either very satisfied (76%) or somewhat satisfied (24%) with the VHS project. In fact, 92% of the superintendents indicated that their school boards were either very positive (62%) or somewhat positive (31%) about the project. When asked about future participation in the project, 57% of the superintendents indicated that they would continue their district’s participation even if there were no outside funding.

Much of the support among administrators seemed to stem from the fact that the VHS fit into or advanced their technology plans. Many of the case study schools were in the process of positioning themselves or had already established themselves as leaders in technology. Administrators assessed the prospects for the VHS project in this context. Most felt that the project was contributing to their vision for the school’s future. As one superintendent put it, the VHS project would help “move the school into the 21st century.” Another superintendent felt that technology projects such as VHS were the pride of the school. Yet another felt that the project provided the school with a lot of positive publicity and enhanced the district’s image with parents and the community. This superintendent indicated that she would like to extend the VHS project by increasing the number of teachers and courses at the district’s participating school, as well as including other high schools in the district. She would also like to see the district become a hub for the project, as it is scaled up, and include local community colleges and businesses in offering courses.

Initial Implementation Problems

The prospects for the first year did not look so promising when the fall term started. As the 400-plus students began logging into a server that had up to that time needed to accommodate only the teachers and project staff involved in the professional development netcourse, access became difficult and wait times became extremely long. Although Concord was quick in responding to the situation by installing larger servers, this early

⁴ The percentages shown have been rounded and thus may not add to the sum-total percentage.

inaccessibility created residual problems that rippled throughout the semester. A large majority of the teachers (82%) who responded to the end-of-year survey said they were not able to implement their courses as planned the first semester. They often cited problems with the technology as a source of their dissatisfaction. Frustration over early access problems was also mentioned by both teachers and students interviewed during initial field site visits. Field site teachers indicated that the early lack of access fostered a pattern of infrequent communication that caused many students to fall behind and sometimes drop out. In one case study course, 3 of the original 14 students dropped out over frustrations with the server. In another school, 4 of 17 students who started the semester dropped out, in part because they became discouraged over server delays. Overall, of the 464 students who started the fall term, only 337 finished—a dropout rate of 27%. However, 73% of the coordinators said that the course completion rate for VHS students was about the same as for students in regular courses.

A second technology-related problem plagued the project early on. A large number of students interviewed during field site visits indicated that they had difficulty using LearningSpace. A range of problems were cited, including:

- Difficulty navigating through the system and finding specific readings
- Difficulty posting responses
- The loss of postings and assignments
- Difficulty printing.

Sometimes the effects of these problems were catastrophic, as when students would “close” instead of “save and close” and would lose all their work. These problems frustrated both teachers and students. One teacher said, “I think I lost half of the kids because of technology.”

Nonetheless, teachers seemed to understand that the delays and initial frustrations with technology were part and parcel of any start-up effort. Their comments on the end-of-year survey reflect a commitment to VHS and to the promise that this technology offers:

It is a challenge and something new. It is like being a first year teacher again. It takes more time to do things. However, there is a certain satisfaction.

I was in the first group; we expected it to be a lot of work and we knew there would be glitches and startup difficulties. This happens on every new project; it’s part of being first.

This is a promising program that deserves the best chance of succeeding—and the additional resources were mostly my own and other teachers’ time, in exchange for substantial professional growth.

By the end of the spring semester, teacher satisfaction with course implementation had turned around. A majority (54%) felt that they **were** able to teach their course as planned. Other survey respondents agreed; 73% of the coordinators, 77% of the principals, and 81% of the superintendents felt that they were able to implement the VHS courses as planned.

Unanticipated Costs

Teachers, coordinators, and administrators all expressed concern that the VHS project required more time and money than they anticipated, but most felt it was worth it and they would do it again despite this fact. All the VHS teachers indicated that their courses required more (24%) or a lot more (76%) time and effort to design and implement for the first time, compared with a regular course.

Much of the additional time was linked to the initial work required to design the course. Several case study teachers also indicated that designing their VHS course took more time than a regular course. “It’s not like a regular course with a textbook where you just have to assign reading,” commented one teacher. She estimated that when she was posting new units, she would spend 2 to 2-1/2 hours a day on her course. Once the units were posted, the demands became more reasonable. Another teacher said, “I was working until 10:30 every night. It takes way more time to set it up than a regular course—it’s like writing a book!”

Despite the demand for extra time, 93% of the VHS teachers felt that the additional investment of resources was justified and acceptable. A large majority of teachers (89%) indicated that they would have been willing to get involved in the project, despite the unanticipated time demands. As one teacher commented in the survey, “[The project] required an incredibly difficult time commitment justified only because I really wanted to do it.”

Similarly, 87% of the coordinators, 77% of the principals, and 76% of the superintendents indicated that the VHS courses required more or a lot more time, money, and effort to design and implement for the first time, compared with a regular course. A large majority of the coordinators (83%) said that the VHS project also required more (39%) or a lot more (44%) of their time than anticipated. Similar to teachers’ responses, 93% of the coordinators, 80% of the principals, and 81% of the superintendents who said

there were unanticipated costs also said the additional resources were justified and acceptable.

Among the expenses for the project, 43% of the principals indicated that they needed to purchase new computers, and 59% indicated that they needed to install computer networks and/or obtain new software. Despite these costs, 96% of the coordinators, 91% of the principals, and all 19 superintendents responding said they would have been willing to spend the additional time, money, and effort, knowing what they knew now.

Another “unanticipated cost” of the project was the shortfall in course enrollments. It was expected that the average enrollment for a VHS course would be approximately 20 students. The enrollment for VHS courses was smaller than expected and significantly smaller than for regular courses, as reported by VHS teachers. Teachers said that the average enrollments in their regular courses was 22.5 students, whereas they reported that the enrollments in their VHS courses averaged 14.4 ($t = 5.62, p < .0001$). According to VHS records, the course enrollments actually averaged 12.0 per class at the end of the fall semester and 12.9 at the end of the spring semester. Course enrollments ranged from a high of 35 students to a low of 2 students. As a result, 55% of the principals felt that the per-student cost of a VHS course was either somewhat more (35%) or a lot more (20%) than that of a traditional course.

The Role of the Site Coordinator

The role of the site coordinator is a unique feature of the VHS structure and important to its successful implementation. Because of this novel status, the coordinator’s role was not detailed at the beginning of the year. As the project was implemented at each school, this position and its functions became defined. In a majority of case study schools, these functions included:

- Handling administrative issues related to course credits, grades, etc.
- Promoting and marketing the VHS project and recruiting and selecting students for the project.
- Reporting to administrators or school board members on the status of the project.
- Coordinating with VHS staff at Concord and Hudson.
- Assisting students with technology.

- Assisting and monitoring VHS students' work and communicating with their VHS teachers.

Some of these functions are administrative overhead for the project: promoting and marketing the VHS project, reporting to the school board, coordinating with VHS staff. These are important but relatively modest tasks that enable the project to work at a local site. Students' teachers would normally perform other parts of the job: monitoring students' progress and addressing problems with their work. At one case study school, all the VHS students did their work during the same period in the site coordinator's classroom. In this school, as well as others among the case study schools, the site coordinator circulated among the students, assisted them with technical problems, and monitored the progress of each student. These site coordinators knew what was required of students in their courses, and they maintained communications with the students' teachers. One student in a case study focus group volunteered that the site coordinator at her school was the "real teacher" in the VHS project.

The range of site coordinators' responsibilities was also reflected in the student survey; 74% said that their coordinators handled administrative matters, such as grades for their VHS course; 68% said they communicated with their VHS teacher; 49% said they helped them use LearningSpace and the computer; and 43% said they helped them stay on schedule and make progress in their course. A majority of the students (75%) said they agreed (38%) or strongly agreed (35%) that they regularly communicated with their VHS site coordinator, and 86% agreed (40%) or strongly agreed (46%) that the site coordinator was regularly available for assistance.

Almost all the teachers (96%) felt that the coordinators' role was an important one that should be continued. Some teacher comments included:

VHS site coordinators are vital to the continued success of the long distance learning program. [Our site coordinator] has been of significant importance to both the VHS students and myself in assisting with the on site management of the VHS program.

I cannot imagine what a school would do without a site coordinator. The role is crucial to the success of the program. The site coordinator is responsible for the students, computers, communication, organization, etc.

The role is vital to the success of the VHS program.

However, 41% of the teachers felt that some changes needed to be made regarding this role, changes such as providing coordinators with more time or requiring them to spend more time staying on top of student work. As one teacher put it: "I think the grant

writers underestimated the importance of this component. It requires more time, more training, and more monitoring for accountability.”

All 23 coordinators who responded said that the role of coordinator was an important one that should be continued. Only 9% said that it needed some changes. A majority (74%) expressed the belief that the position of site coordinator would be continued at their school even after supplemental funding was discontinued.

Coordinators reported spending a mean of 12.8 hours per week in their role; 83% said that they spent more (39%) or a lot more (44%) time than they anticipated. Much of this time was spent on administration or working with students. Principals agreed; 76% of them said that the site coordinators’ role required more (52%) or a lot more (24%) time than anticipated.

Goal 2. Schools, Teachers, and Students Will Benefit

Participation in the project resulted in many benefits to teachers, students, and schools. Teachers acquired new technological skills, new pedagogical and assessment skills, and new content knowledge. They had access to new technology and to technical, subject matter, and curricular experts. They collaborated with other teachers from around the country. Students also acquired new technological skills and had access to new technology.

Courses Offered That Were Not Available Otherwise

The most pronounced benefit of the project was that schools were able to offer, teachers were able to teach, and students were able to take courses that would not have been available otherwise. A majority of coordinators (78%), principals (82%), and superintendents (71%) said that their teachers were able to teach courses that they could not have taught otherwise. At the beginning of the school year, a majority of administrators mentioned that this was an important feature of the VHS project. Principals, for example, when asked why they decided to participate in VHS, most often said it was because of the prospect of expanding course offerings to their students.

Several teachers in the case studies indicated that they were now teaching advanced or specialized courses they had always wanted to teach but were not able to teach previously. These courses would not have attracted enough enrollments within individual schools, but by extending the potential enrollment pool to 27 schools across the country, VHS created the enrollments that allowed teachers to offer these courses.

Conversely, students at the receiving end benefited from the range of subjects offered by VHS. A large majority of the students (85%) said that their courses were available to them only through the VHS project, and most (62%) listed this fact as a reason for their participation in the project. All of the coordinators, principals, and superintendents said that because of VHS, their students were able to take courses that were not available otherwise.

Large majorities of coordinators (77%) and principals (95%) and all the superintendents said that the VHS course offerings were important ones. Even though the VHS courses were not part of the core curriculum, they played a unique and important curricular role for participating schools. Tight school budgets have often required schools to concentrate their resources on core courses at the expense of electives. Yet, as administrators mentioned, parents often expressed a need for electives that would allow students to go beyond these core requirements. With VHS, schools could resolve this tension by having an extended set of electives available to their students for the price of the one course offering needed to participate in the project. As one superintendent said during a field site visit, “One of the big pushes for this school is that we want to have more elective courses. That’s one of the reasons the Virtual High School was welcomed with open arms. We couldn’t offer those electives because we had to offer the core courses.”

Flexible Scheduling

Just as the pooling of enrollments across schools was an important factor in enabling course offerings, so was the flexibility provided by the asynchronous nature of the VHS structure. This flexibility allowed teachers to teach and students to take courses at their convenience and as they fit into their schedules. A majority of VHS teachers (59%) indicated that they were “very satisfied” with the flexibility that VHS provided.

Teachers in four of the five case study schools indicated that they were able to work on their VHS course on their home computers. Occasionally, teachers used this time to plan their courses and develop course materials. More often, they used their time at home to interact with students and other teachers. This ability to work outside of the normal frenetic activity of the school day may be the reason that teachers were able to give students the one-on-one attention that was often mentioned by focus group students as an advantage of the project. On the other hand, this ability to work at home may have come to intrude on teachers’ free time and add to the perceived demands of the VHS project on teacher time.

Students also indicated that they liked to be able to work when and where they wanted. A majority of students (58%) cited as an advantage of VHS courses over traditional courses the fact that they could take their VHS course at any time; 52% cited the ability to take their course from home as an advantage. Students at the case study schools mentioned that they often did their work at home, where many had access to computers and modems. Some indicated that they liked the self-pacing of courses.

New Skills, Knowledge, and Colleagues for Teachers

Important benefits of VHS for participating teachers were the new skills and knowledge that they acquired as a result of the Teacher Learning Conference and their experience teaching their VHS courses. It is not surprising that some of these benefits were technological; 79% of the VHS teachers indicated that they acquired new technological skills, and 83% indicated that VHS gave them the opportunity to use hardware and software they would not have used otherwise. Site coordinators, principals, and superintendents confirmed these findings. A large majority of each group said that their teachers acquired new technological skills as a result of their VHS participation and had access to hardware and software they would not have used otherwise.

These newly acquired technological skills were also being used in other non-VHS courses and in other aspects of teachers' professional lives. Teachers commented in the survey:

I am planning to take a graduate course via long distance learning. A year ago I would not have had the Internet skills or confidence to undertake such an opportunity.

I will include the Internet and other technology in my other courses.

Teachers also acquired new content knowledge, as a result of their participation. A large majority of VHS teachers (86%) indicated that they increased their existing subject matter knowledge as a result of their participation in VHS, and 59% indicated that they acquired new subject matter knowledge. Coordinators, principals, and superintendents agreed.

Teachers also benefited from their participation by acquiring and using new pedagogical techniques. A majority of VHS teachers (69%) said that they acquired new teaching or assessment approaches, and 55% indicated that they used new teaching or assessment approaches in their other courses. Administrators agreed, with 82% of the

principals and 76% of the superintendents saying that their teachers acquired new teaching or assessment skills. Teachers commented about the impact of VHS on their teaching:

VHS has created professional opportunities for me; has pushed me to reflect on teaching and learning.

VHS has also greatly influenced my classroom teaching and I think that has been hugely positive.

A majority of the VHS teachers reported using the following approaches or techniques in their VHS courses: cooperative learning approaches, in which students collaborate on projects and assignments (90%); inquiry-based projects that engage students in the in-depth study of significant concepts and principles (83%); performance-based assessment activities or materials that measure knowledge, reasoning, collaboration, and self-reflection (76%); the generation of reports and other products that students share electronically with the community or other audiences (66%); and connecting school learning with work experience or real-world applications (62%).

Administrators confirmed that teachers used these skills in their teaching. A majority of the principals (60%) said their teachers had the opportunity to use alternative methods more in VHS courses than in traditional courses, and 68% said that their teachers were able to present subject material in innovative ways in VHS courses. Responses from administrators suggest that traditional courses also benefited from teachers' new skills. Both principals (64%) and superintendents (71%) felt that their teachers used new teaching or assessment approaches in their other courses as a result of their participation.

As a consequence of their VHS participation, teachers also benefited by having access to a number of other teachers that they would not have had access to otherwise. A large majority of the VHS teachers (86%) said that they increased their interaction with teachers at other schools, and 78% said that they collaborated with these new colleagues in teaching their courses. Coordinators and administrators agreed; 82% of the coordinators, 91% of the principals, and 91% of the superintendents indicated that VHS gave their teachers an opportunity to collaborate or interact with those from other schools and districts. In their own words, teachers enumerated the advantages of interacting with other teachers:

Learning about other schools (e.g., their schedules, etc.) and "meeting" people in other geographic areas.

Comparing the quality of our students to those around the country—learning new teaching strategies.

Contact with teachers and students everywhere has been a big plus!

New Skills and Knowledge for Students

An important finding from the study is that students acquired new knowledge and skills as a result of taking VHS courses. As with teachers, some of this pertained to the technology; 44% of VHS students cited the use of technology on a regular basis as an advantage of the VHS courses over their regular courses. In fact, 41% of the VHS students said that a reason they took their VHS course was that they wanted to learn more about technology and the Internet. In turn, all VHS teachers who responded to the survey said that they were either very (61%) or somewhat (39%) satisfied with their students' technological ability. A large majority (87%) of the coordinators said that students had an opportunity to use hardware or software that they would not have used otherwise, and 91% said that students acquired new technological skills as a result of their participation in VHS.

Administrators agreed, with 77% of the principals and 62% of the superintendents saying that students had an opportunity to use hardware or software that they would not have used otherwise. Also, 86% of the principals and 76% of the superintendents said that students acquired new technological skills as a result of their participation in the project.

More than 81% of VHS students said that, compared with their normal school program, VHS courses are a very different way to learn. Coordinators and administrators agreed, with 78% of the coordinators, 73% of the principals, and 86% of the superintendents saying that students engaged in new kinds of pedagogical activities or produced new kinds of products as a result of participating in VHS.

Students also reported that they put a considerable effort into their VHS courses, with 66% of VHS students either agreeing (46%) or strongly agreeing (21%) that they worked as hard or harder in their VHS course than in other courses. However, 48% of the coordinators indicated that students spent about the same time studying for VHS courses and for regular courses.

A majority of the VHS teachers (79%) said that they were either somewhat (57%) or very (21%) satisfied with the extent to which their students were actively engaged in the subject matter of their courses, and 83% of them were either somewhat (62%) or very (21%) satisfied with the amount that students learned in their courses. A very large majority (93%) were either somewhat (72%) or very (21%) satisfied with the extent to

which students were able to grasp the concepts taught in their courses, and 96% were either somewhat (75%) or very (21%) satisfied with the extent to which students improved their attitude about the subject matter of their courses. Student self-assessments concurred, with 79% of the VHS students either agreeing (50%) or strongly agreeing (29%) that they learned a substantial amount about the subject matter in their course. However, 61% of the coordinators felt that students learned only about the same amount in their VHS courses as in their regular courses.

Goal 3. Courses Will Be of High Quality

All indications are that, as a group, the VHS project offered high-quality courses taught by very qualified teachers.

Qualified Teachers

Teachers participating in the first year of the Virtual High School project were generally experienced. The average cumulative full-time experience of VHS teachers was almost 15 years, averaging almost 11 years of tenure at their current schools. A majority (63%) held a master's degree or higher. Many (30%) had a second bachelor's degree.

Almost all (97%) of the VHS teachers had a teaching certificate in their main teaching assignment. An overwhelming majority (90%) had designed a new course before their involvement in VHS.

Course Quality

All participants—students, teachers, coordinators, principals, and superintendents—were satisfied with the quality of VHS courses. Among students, 83% either agreed (55%) or strongly agreed (27%) that the content in their course was of high quality. A majority of VHS students (73%) said that their VHS course was one of the more interesting courses they were taking, and 65% said that their VHS course was one of the more enjoyable courses they were taking.

A very large majority of VHS teachers (93%) said that they were somewhat (62%) or very (31%) satisfied with the quality of the VHS courses that they taught. On a 4-point scale of satisfaction (where “1” is “very” and “4” is “not at all”), teachers responded with a mean rating of 1.8 on their satisfaction with the quality of their VHS courses. Similarly, 90% of the teachers said they were somewhat (41%) or very (48%) satisfied with the level of challenge and rigor of their VHS courses.

Coordinators and administrators agreed with student and teacher assessments; 87% of the coordinators, all of the principals, and all of the superintendents were either somewhat or very satisfied with the quality of the VHS courses taught by their schools. As for VHS courses taught by other schools, 96% of the coordinators, 90% of the principals, and 94% of the superintendents were either somewhat or very satisfied with their quality.

On the other hand, even though teachers rated the quality of their own VHS courses very high, they rated the quality of their regular courses even higher. In particular, 93% of the VHS teachers said they were somewhat (29%) or very (64%) satisfied with the quality of the regular courses they taught and they rated their satisfaction with the quality of their regular courses a mean of 1.4. The teacher ratings for their regular courses are significantly higher than those for VHS courses ($t = 2.54, p < .05$).

Level of Communication

Another indication of course quality is the level at which students are engaged in course activities over the network. A majority of the VHS students (69%) either agreed (46%) or strongly agreed (23%) that discussion was a regular part of their VHS courses. Similarly, 71% of the students either agreed (47%) or strongly agreed (24%) that the teacher frequently communicated with them individually or as part of a group. A larger majority (82%) either agreed (43%) or strongly agreed (38%) that communication with the teacher was an important part of their learning. There was a consensus among students that teachers established clear standards by which the assignments would be judged (69% either agreeing or strongly agreeing), that they got comments and/or grades from the teacher for each assignment in a timely manner (73% either agreeing or strongly agreeing), and that they knew how they were doing in the course (75% agreeing or strongly agreeing). Similarly, 73% of the students either agreed (38%) or strongly agreed (35%) that they communicated with their site coordinator on a regular basis.

On a 4-point scale of satisfaction (where “1” is “very” and “4” is “not at all”), VHS teachers responded with a mean rating of 1.9 on satisfaction with their ability to communicate individually with students enrolled in their VHS courses. A majority (79%) of the teachers were either somewhat (48%) or very (31%) satisfied with the extent to which they were able to communicate individually with students enrolled in the course.

Whereas communication between teachers and students, and between coordinators and students, seemed to be at a satisfactory level, communication among students was

rather low. Only 45% of the students either agreed (36%) or strongly agreed (9%) that they frequently communicated with other students, and 46% either agreed (37%) or strongly agreed (9%) that student discussions and teams were well managed. Only 34% of the students indicated that they could get to know teachers and students from other parts of the country with their VHS course more than they would otherwise. However, it seemed that communication with other students was less important to students. Only 32% of the students indicated that this was why they took a VHS course, and 45% either disagreed (29%) or strongly disagreed (15%) that communications with other students were an important part of their learning.

Perhaps the low level of student interaction should not be surprising, for focus group students often mentioned that working independently was an important value to them. Also, both case study teachers and coordinators indicated that student independence was a criterion often used to select students into the VHS project. An extremely high proportion (97%) of the students said that it was either important (22%) or very important (75%) to students' success in VHS courses that they enjoy working independently. Of those students who indicated that their VHS experience would benefit them in the future (82% of the students said that it would), 61% said it was because they became a more independent learner. Teachers concurred; 77% either agreed (71%) or strongly agreed (7%) that they were satisfied with their students' ability to work independently in their courses.

Goal 4. VHS Will Demonstrate Advantages, Compared to Traditional Courses

Although VHS courses were similar to traditionally offered courses in some ways, there were some distinct advantages to teaching courses on the Internet, relative to traditionally delivered instruction. There were also some relative disadvantages that point out work yet to be done in the project and perhaps some basic limitations to the approach.

Access to Technology

It comes as no surprise that VHS courses provided technological advantages over regular courses. Many students (44%) said that the regular use of technology was among the advantages of their participation in VHS, compared with their regular courses. Consequently, teachers gave a mean rating of 1.4 (on a 4-point scale, "1" being "very satisfied" and "4" being "not at all satisfied") on their satisfaction with the ability of their students to use technology in their VHS courses. For VHS courses, all the teachers were

either somewhat (30%) or very (61%) satisfied. Their satisfaction rating on this measure was significantly higher for their VHS courses than for their regular courses, where they gave a mean rating of 2.0 ($t = 4.01, p < .0005$). For regular courses, 68% of the teachers were either somewhat (36%) or very (32%) satisfied with students' technological ability.

Use of Innovative Instruction

As reported above, VHS teachers used a variety of innovative approaches in their netcourses. However, teachers tended to use these innovative approaches no more or less often, statistically speaking, in their VHS courses than they did in their regular courses. In general, VHS teachers used cooperative learning approaches (VHS 90%, regular 96%), inquiry-based projects (VHS 83%, regular 85%), performance-based assessment activities (VHS 76%, regular 67%), and activities that connect school learning with real-world applications (VHS 62%, regular 82%) about the same in both types of courses. There was one exception. In VHS courses, teachers were more likely to have students generate reports and other products that they shared electronically with other audiences than they were in regular courses (VHS 66%, regular 37%; $t = 2.27, p < .05$).

Use of Outside Resources

The Internet provided VHS teachers with access to a wide variety of resources that they did not have available to them for their traditional courses. VHS teachers reported that they collaborated with other teachers more often in teaching their VHS courses than their regular courses. Teachers rated the extent of collaboration with other teachers in their VHS courses a mean of 1.9 on a 4-point scale ("1" is "a lot" and "4" is "not at all"); they rated collaboration in their regular courses a mean of 2.2 ($t = 2.14, p < .05$). Whereas 78% of the teachers said that they collaborated either some (41%) or a lot (37%) with other teachers in teaching their VHS courses, 70% said they collaborated with others either some (48%) or a lot (22%) in their regular courses.

In addition, teachers took advantage of a wide variety of other outside experts to plan and implement their VHS courses, much more so than for their regular courses. Teachers gave comparative ratings, using the same 4-point scale, on their use of the following resources:

- Subject matter experts ($m = 2.0$ for VHS courses, $m = 2.4$ for regular courses; $t = 2.38, p < .05$).
- Curriculum and teaching experts ($m = 2.6$ for VHS courses, $m = 2.9$ for regular courses; $t = 2.27, p < .05$).

- Technical experts ($m = 2.1$ for VHS courses, $m = 2.9$ for regular courses; $t = 5.04$, $p < .0001$).

However, teachers rated their use of expert materials no differently for their VHS and regular courses. They used expert materials extensively in both types of courses, giving this resource a mean rating of 1.5 for both their VHS and regular courses.

Coordinators and administrators agreed with the assessment of their teachers; 82% of the coordinators, 86% of the principals, and 71% of the superintendents said that, as a result of participation in VHS, their teachers had access to and took advantage of technological, subject matter, or pedagogical experts that they otherwise would not have had access to.

However, whereas VHS teachers used these outside resources to help them plan and implement their courses, they did not use such resources in the teaching of their courses. By and large, then, VHS students did not have access to these outside resources. Despite the potential for using the network to bring new people into the electronic classroom, VHS courses were still quite traditional in this regard. In general, VHS teachers were no more likely to include others in the teaching of their VHS courses than their regular courses; corporate staff, scientists, college students, and senior citizens were rarely used in either type of course. Whereas other teachers were used more often in VHS ($m = 1.9$ on a 4-point scale, with “1” being “a lot” and “4” being “not at all”) than in regular ($m = 2.2$; $t = 2.14$, $p < .05$) courses, parents were more likely to be involved in regular courses ($m = 2.9$) than in VHS courses ($m = 3.7$; $t = 4.32$, $p < .0005$). Only 30% of the coordinators said that other experts (such as parents, corporate mentors, or scientists) directly participated in the education of their students in VHS courses.

There were some indications that teachers were beginning to think about how they could pull outside resources into their virtual classes. For example, a teacher in one of the case study schools who was offering a course on Russian studies said that the next time she taught it she wanted to involve students in the Ukraine. A teacher offering the poetry course wanted to do so next time in conjunction with a local community college. The site coordinator at one school was negotiating with the local newspaper about collaborating on a journalism course that might be offered through VHS in the future. The unique advantages of the VHS project are likely to emerge as the base of experience builds for participating teachers, site coordinators, and administrators.

Levels of Communication

As mentioned above, both students and teachers were satisfied with the level of communication in VHS courses. However, teacher satisfaction with communication was significantly lower for their VHS courses than their regular courses. On a 4-point scale of satisfaction (where “1” is “very” and “4” is “not at all”), teachers responded with a mean rating of 1.9 on satisfaction with their ability to communicate individually with students enrolled in their VHS courses. A majority (79%) of teachers expressed satisfaction with the extent to which they were able to communicate individually with students in their courses (48% somewhat, 31% very satisfied). However, VHS teachers responded with a mean satisfaction rating of 1.3 ($t = 2.56, p < .05$) for their regular courses. A larger majority (89%) of VHS teachers said they were either somewhat (11%) or very (79%) satisfied with their communication with students in their regular courses.

Coordinators were less satisfied than teachers with the level of communication; 57% of the coordinators said that VHS students interacted with their VHS teacher **less** (44%) or **a lot less** (13%) than they did with teachers in regular courses. Furthermore, 77% of the coordinators said VHS students interacted with other students less (50%) or a lot less (27%) than they would in their regular courses. From site visit reports, coordinators and teachers commented that the length and frequency of assignments varied by course, and in some cases, communication with a VHS teacher was as infrequent as once a week or less often.

An informal examination of interaction records in the case study courses indicated that the dominant mode of interaction in these courses was teacher-student exchanges, replicating the question-answer or lecture patterns of interaction in more traditional classrooms. The system did seem to support more one-on-one interaction between teachers and individual students than is common in traditional classrooms, and some focus group students mentioned this as an advantage.

Comments of students in the focus groups about their satisfaction with course communication varied considerably, depending on the course they took. Many students commented on the social quality of their experience. Some felt that their VHS teachers knew them well and were responsive to their requests and messages; indeed, some felt that they got more individual teacher attention than they might get in a regular class. Students in these courses felt connected to the teachers and to other students in their courses. As one student put it, “This is definitely **not** impersonal.”

Other students felt that their teachers did not know them at all and were not responsive. This belief was pronounced with one particular course, which students and site coordinators at several case study schools identified as problematic. One student who was enrolled in this course mentioned that the teacher had posted new material and comments only five times all semester. Another student reported receiving no marks or grades back on any of 20 completed assignments. The problem with this course has since been remedied by VHS staff.

A related problem was the relatively low level of day-to-day on-line activity in many courses. This problem was documented by student and teacher comments, as well as by informal analyses of course communication logs. Students in four of the five case study focus groups indicated that only a minority of students in their courses were on-line daily. One case study teacher estimated that only 5 of the 11 students in her course were active on a regular basis. Another teacher estimated that only 4 of her 9 students were on-line regularly.

Focus group students also noted that there was little interaction among students in their courses. In most courses, the dominant mode of communication was between teacher and student; most courses were not structured to encourage student-student interactions. As one student put it, "I didn't think I would be taking a correspondence course, but that's what it is." Another said, "The personal touch is just gone . . . This is just dealing with a computer. It's not interactive at all."

Many students, even some who commented positively on teacher responsiveness, indicated a frustration with the slowness of interactions on the system. Even answers to the simplest questions would require a day or two for a response. Sometimes the need for this answer and the slowness of response would slow students' progress in the course. For this reason, as well as the previously mentioned technology problems, students were behind in their courses during the first semester. Often, they expressed great anxiety about the effect this delay would have on their grade.

Levels of Learning

Teachers reported a high degree of satisfaction with the learning of students in their VHS courses, but again it was less than the satisfaction they had for the amount of learning that occurred in their regular courses. On a 4-point scale of satisfaction, teachers responded with a mean rating of 2.0 on their satisfaction with the amount students learned in their VHS courses. A majority of the teachers (82%) were either somewhat (62%) or

very (21%) satisfied with the amount that students learned in these courses. This is significantly lower, however, than teachers' satisfaction with the amount students learned in their regular courses, where they responded with a mean rating of 1.6 ($t = 2.20$, $p < .05$). A greater majority (89%) said they were either somewhat (39%) or very (50%) satisfied with the amount students learned in their regular courses.

Goal 5. VHS Will Become a Model for Network-Based Courses

This goal addresses the need for the VHS project to take on a sustainable form, one that can continue when special funding goes away. It also includes the intent to scale the project up to include larger numbers of courses, schools, and students. Initial evidence suggests that most administrators would continue the project even after supplemental funding stopped. Nonetheless, two issues are identified that may affect scalability: technological issues and the site coordinator's role.

Continuation after Funding

General levels of satisfaction expressed by teachers, coordinators, principals, and superintendents suggest that the VHS is a sustainable model. Most importantly, 78% of the principals and 57% of the superintendents said they would continue in the project even if there were no outside funds to support their participation. This endorsement comes despite the acknowledged unanticipated time demands of implementing the project.

Technological Scalability

The server problem that so affected the beginning of the semester has been resolved for the time being. But it may crop up again as the VHS project scales up. Because inaccessibility has such a significant and persistent impact on student attitudes and productivity, unresolved or recurring server problems threaten VHS as a model for network-based instruction. This prospect suggests that Concord technical staff should collect data on server demand and performance and use these to compute a scale-up trajectory that will anticipate server demand as courses and students are added.

Scaling the Site Coordinator's Role

The various tasks associated with the site coordinator's role also need to be reviewed with an eye to sustainability and scalability. As mentioned earlier, some aspects of the site coordinator's role are more administrative: recruiting teachers and students, coordinating with local administrators and VHS staff, etc. These tasks represent a

relatively modest overhead cost that is not likely to increase significantly as the project scales up within a school. A single person can probably handle project promotion and the recruitment of a relatively large number of local students and administration of locally offered courses.

On the other hand, student monitoring and coordination seems to be an important but much more time-consuming part of the coordinator's role. Students seemed more satisfied in schools where the site coordinators were more involved in student monitoring and support. Yet, this is the part of the coordinator's role that can become problematic as funding is discontinued or the project is scaled up. The cost demands of the VHS project are modest if the trade between providing a teacher and receiving a number of student slots (say 20) is nearly even, because the services being provided and received are nearly equivalent. However, if in addition to a distant teacher, local VHS students in each course require significant assistance from a local staff person (i.e., the site coordinator), the costs of the project rise significantly. In effect, a VHS course takes two teachers, and the costs are doubled.

Furthermore, this aspect of the site coordinator's role has limited scalability. As the numbers of students, teachers, and courses increase, a single person will have difficulty monitoring students, knowing the requirements of the courses that they take, and communicating with the many teachers of these courses. Indeed, the current level of effort seems to be the limit of the time available to site coordinators with 20% of their time released for the project. Coordinators in three of the five case study schools indicated that it would be difficult for them to do their job if their schools offered more VHS courses or more students in their schools enrolled in VHS courses. In the end-of-year survey, 91% of the coordinators said that their role would change significantly if the number of VHS students grew significantly. Most said the increase would require additional time monitoring and supervising the students. Structuring an economically sustainable and scalable role for the site coordinator will be a significant near-term task for the VHS project, an issue that is taken up again in Chapter IV.

Goal 6. Benefits Will Be Equitably Available

Support for diversity across schools and students was an important component of the original VHS proposal. Consequently, an important goal is to assure that the resources of VHS are equitably available to a range of students and schools.

Representativeness of VHS Schools

As a group, VHS schools are similar in many ways to other schools in the country. Principals reported that, on average, 18% of the students in their schools received free or reduced-price lunches. This compares with 22% in secondary schools nationally. The superintendents reported a comparable district average figure of 29%, which compares with 33% nationally for all school districts. The averages, however, mask the fact that there is a wide variation, with 21% of the VHS principals reporting almost no students participating in the school's free/reduced-price lunch program, while 25% reported that more than one-fourth of the students participated.

The average proportion of nonwhite students in the participating high schools was 29%, according to the principals. For all schools in the districts participating in VHS, the corresponding figure was 30%, according to the superintendents. These figures are close to the national average of 34% nonwhite students. A number of the VHS schools, 17%, had an enrollment of more than 50% nonwhite students; in slightly more than a third of the schools, white students made up 90% or more of the enrollment.

Reported per-pupil expenditures, according to the superintendents, averaged about \$5,700 for all schools in their districts. That figure is very close to the national average of more than \$5,800 ("current expenditures per pupil"). The VHS schools thus appear to be only slightly "poorer," on average, than the typical U.S. school. Again, there is a wide variation in per-pupil expenditures, with some VHS schools and districts reporting per-pupil expenditures of \$9,000 or more.

Socioeconomic Mix among VHS Students

Teachers were asked about the ethnic and economic characteristics of their VHS students. However, response rates from teachers were too low on those questions to consider them in the analysis. They often said that they did not know the race of their students, given that they interacted with them only on-line.

Because the coordinators knew the VHS students in their schools, they could respond reliably to these questions. Their responses indicate that the VHS project focuses on a rather narrow range of students. About half of the coordinators (52%) said that VHS students did **not** come from a full range of socioeconomic backgrounds present in their schools. Rather, 92% of these coordinators indicated that the VHS students came from relatively affluent backgrounds; 71% of the coordinators said that VHS students in their schools were less (19%) or a lot less (52%) likely to come from economically

disadvantaged backgrounds than students in their regular courses. A majority of the coordinators (68%) said VHS students were less (14%) or a lot less (54%) likely to be from a limited-English-speaking family than students in their regular classes. About half (48%) said that the ethnic background of VHS students was about the same as that of students in regular courses.

Of those coordinators who said the VHS students represented the full socioeconomic range in their schools, 73% said that VHS course completions were equally distributed across this range.

Student Academic Goals

A large majority (85%) of the VHS students said they planned to attend a 4-year college after they graduated from high school. Correspondingly, 78% of the coordinators said that their VHS students had an above-average (52%) or exceptional (26%) history of academic performance. Only 13% of the coordinators said that their VHS students came from a wide range of prior academic histories. Similarly, 61% said that their VHS students were more (30%) or a lot more (30%) likely to be enrolled in a college preparatory program than students in regular courses.

Perhaps these findings should not be surprising since 50% of the teachers reported that the courses they taught in the winter semester were honors or advanced placement courses. A majority of teachers (68%) also said that VHS students were less (18%) or a lot less (50%) likely to drop out of school than students in regular courses.

Gender Mix of VHS Students

Teachers reported that 47% of their students in the winter semester were females. This proportion is verified by students, 48% of whom said that they were female. Teachers also reported that equal numbers of male and female students dropped out of their courses after the first week; an average of 2.1 males and 2.1 females dropped out.

Goal 7. Professional Development Will Be of High Quality

Most of the VHS teachers responded positively about the Teachers Learning Conference (TLC), a graduate-level netcourse that constitutes the primary teacher professional development activity of the project. A majority of the teachers (77%) felt that the TLC was either very (29%) or somewhat (50%) effective in preparing them to plan and implement a VHS course. Similarly, 75% felt that the course was either very

(39%) or somewhat (36%) effective in preparing them to use technology in their teaching. The coordinators agreed; 96% of them felt that teachers were either very (87%) or somewhat (9%) effective in their use of computers and networking in their teaching.

Relatively few comments were made about the TLC during the field site visits. Those made were generally positive; teachers said that the TLC was helpful in getting them started with their netcourses. One teacher felt that the TLC was a bit difficult to follow; she felt she would have benefited from a manual to accompany the course. Another teacher thought it was useful to know what to call various pedagogical approaches, but he did not believe that it enhanced his instruction. He would have preferred to have more instruction on how to use the software. Along a similar vein, another teacher would have preferred to spend more time developing her course than discussing education reform. She felt that the TLC was preaching to the choir: "None of us would be involved if we did not believe in reform of some kind." The teachers also commented positively on the teachers' meeting convened in Boston.

IV. CONCLUSIONS AND KEY ISSUES FACING THE VIRTUAL HIGH SCHOOL

Summary of Results

Surveys of students, teachers, and administrators and case studies of participating schools document that the Virtual High School had a successful first year of implementation. Although teachers felt that they were not able to implement their courses as planned during the first term, teachers, coordinators, principals, and superintendents all agreed that the program was implemented as planned by the end of the school year. Large majorities of students, teachers, coordinators, principals, and superintendents expressed overall satisfaction with the project. Students, teachers, and administrators also expressed satisfaction with the quality of VHS courses.

Both teachers and administrators said that the project cost more than anticipated. They went on to say, however, that the additional investment of resources was justified and acceptable, and they would spend these resources again, knowing now what is required. Most administrators said they would continue in the project even after external funding was discontinued.

Participation in the project resulted in many benefits to teachers, students, and schools. Teachers acquired new technological skills, new pedagogical and assessment skills, and new content knowledge. They had access to new technology and to technical, subject matter, and curricular experts. They also collaborated with other teachers from around the country. Students also acquired new technological skills and had access to new technology. The most pronounced benefit of the program, however, was that schools were able to offer, teachers were able to teach, and students were able to take courses that would not have been available otherwise.

Although teachers used a variety of innovative pedagogical approaches (such as cooperative learning, inquiry-based projects, and performance-based assessment), they used these no more often than they did in their regular courses. The exception was the use of student-generated reports, which teachers used more often in VHS courses than in their regular courses. Teachers collaborated **more often** with other teachers in their VHS courses than in their regular courses, but they collaborated with parents **less often** in VHS courses. They rarely collaborated with corporate staff, scientists, college students, or seniors in teaching either their VHS courses or their regular courses.

A majority of students felt that their teachers communicated with them regularly, and most teachers were satisfied with the extent of their communication with students. But teachers were significantly **more satisfied** with the level of communication with students in their regular courses than in their VHS courses. A majority of coordinators also felt that their VHS students interacted **less often** with both teachers and other students in their VHS courses than in their regular courses.

A large majority of students felt that they learned a substantial amount in their VHS courses. Similarly, teachers were satisfied with the extent that students were able to grasp concepts in their VHS courses and the extent to which they improved their attitude about the subject matter. Most were also satisfied with the amount students learned, but they were significantly **more** satisfied with the amount students learned in their regular courses.

A majority of coordinators said that VHS students did **not** come from the full range of socioeconomic backgrounds present in their schools but came from relatively affluent backgrounds. Coordinators said that most VHS students had above-average or exceptional academic backgrounds and were college bound.

Key Issues

Despite a successful first year of implementation, several issues may surface in the future and will need to be addressed if the project is to be sustained beyond the funding period and be extended to other school districts.

Assuring Course Quality

As mentioned above, students, teachers, coordinators, and administrators all expressed satisfaction with the courses offered by the VHS project. Administrators in three of the five case study schools indicated that they expected and assumed that the VHS course offerings were of high quality. One administrator pointed out that he treated VHS courses like transfer courses; the quality is taken for granted. Nonetheless, the quality of VHS courses is a key to the sustainability and scalability of the project. As one case study administrator put it, “Without quality, they don’t have a real virtual high school.”

There are two related aspects to assuring course quality. One is local in nature. For example, the curriculum director in Allen Independent School District had to write a 90-page proposal to the Texas state education agency to get approval for offering the VHS courses to their students. At Kennedy High School in Fremont, California, all the courses

were submitted to and approved by the school's normal course-approval committees. In this case, the superintendent felt that the process resulted in a buy-in for the VHS program by many teachers in the system. At Miramonte, another California high school, the courses had to be reviewed by a university agency to classify them for the university's admission requirements. In this case, 25 of 30 VHS courses were approved, but 5 were not considered college preparatory courses.

There is also an aspect of course quality that must be addressed by the VHS central staff. It is clear that there will always be local issues and considerations in assessing the quality and acceptability of VHS course offerings; it is also clear that superintendents feel that VHS staff must play a key role in reviewing course quality. Currently, administrators are assuming that VHS courses are of high quality, but ultimately it is likely that VHS will need to assure this quality in some way. The VHS staff thus may need to establish standard criteria and/or procedures for reviewing the quality of course offerings. These standards may be applied by an external panel of experts that represent a range of constituencies, such as academic associations (e.g., National Council of Teachers of English, National Council of Teachers of Mathematics), state education agencies, university admissions officers, and employers. This body could review course materials and certify that they meet high curricular and pedagogical standards. These course evaluations could be documented for each course, and this material could be shared with participating districts. District administrators then could use these evaluations in any subsequent review required for local purposes.

Improving Learning and Course Communication

Both students and teachers reported that students learned as a result of their VHS courses, but the learning that teachers reported was less than that in their regular courses. The evidence of learning is currently based on self-report data. Ultimately, it will be important to obtain more direct and objective measures of student learning. The level of learning in VHS courses will need to be compared with that in similar courses offered in more traditional ways.

Similarly, both students and teachers expressed satisfaction with the level of communication between them, but teachers were less satisfied with the level of communication in their VHS courses than in their regular courses. Coordinators actually reported that VHS students communicated less with their teachers and with other students in their on-line courses than in their regular courses. Students in four of five case study

focus groups indicated that only a minority of students in their courses were on-line daily. Some students noted the impersonal quality of the courses.

Although the low level of interaction could be attributed to the relative newness of the VHS approach for teachers and students, the problem may be more fundamental. Because the asynchronous nature of the communication system allows participants to log in at any time, it reduces the likelihood that anyone else will be available at that same time. The resulting time lag in responding to questions or conversational turns reduces the responsiveness of the system and the sense of community. Focus group students mentioned this issue as a problem.

In LearningSpace, students are able to interact only with the teacher and other students in their individual courses. This tight binding between students and their courses eliminates the opportunity for students to go elsewhere to look for immediate help or to form relationships outside of their immediate class. Such relationships might sustain engagement, motivate learning, and contribute to a sense of on-line community. The addition of synchronous communication and the opportunity for cross-course communication may increase the amount of interaction within the system and increase learning.

Within the current structure of LearningSpace, some courses seemed to generate more interaction than others. One of the case study courses, the Poetics and Poetry course offered by Kennedy High School, generated a significant amount of communication and engagement. The 17 students in this course were very active; at the time of the case study visit in October, the teacher estimated that there had been between 500 and 600 comments in the Discussion Forum. The teacher structured this course with frequent but brief assignments, and much student-student interaction related to these assignments. When appropriate, she would redirect students' private messages to the whole group so that they would stimulate discussion and everyone would benefit. The teacher also kept close track of all the students' assignments and progress. Consequently, she felt she knew each student individually, a perception that was confirmed by student comments at several other sites. Perhaps this level of involvement is why no students had dropped out of this course at the time of the case study visit.

The finding for this course suggests the need for an in-depth study that systematically examines the structure of assignments, teacher communication strategies, and student communication patterns across VHS courses. The range of these patterns, in turn, could be correlated with direct measures of student learning to identify the most

effective ways of structuring course assignments and student discourse. Disseminating these effective strategies through the TLC could dramatically increase the amount of learning that is fostered by the VHS project.

Employing the Power of Networked Technology

Currently, VHS teachers are using the power of networked computers to collaborate with other teachers, content experts, curriculum experts, and technical experts. However, this collaboration with outside resources has not yet been extended to students. In many ways, VHS courses are similar to traditional courses, in that the primary source of information is the teacher and authoritative text material. Although it is true that in the case of VHS this text material is on the Web, the network is not currently being used to link students with other outside resources, such as scientists, authors, corporate experts, senior citizens, and college students. This traditional structure may be created—or at least reinforced—by the structure of LearningSpace. Currently, LearningSpace assumes, indeed requires, that participating students be divided up into restricted groups assigned to a specific course and that these courses be defined by specific topics associated with particular curricular materials selected by the teacher. These strictures reinforce a more traditional teacher-oriented format of a course.

If the LearningSpace environment can be opened up to authorized others, VHS teachers could take advantage of the network to allow students to be mentored by senior citizens or college students, could augment the teaching of a course by bringing in experts from business and science, could provide students with collaborators from other countries and cultures, could support cross-disciplinary connections between two courses (such as joint projects between students in a history and a science course), and could present students with authentic audiences for the products of their learning. Students in different courses also could be provided with more opportunities to interact (as they do in regular schools, for example, in the halls or over lunch). These alternative arrangements would take advantage of the power and pervasiveness of networked computing and are more closely aligned with student-oriented, project-based educational reforms (Kozma & Schank, 1998).

Increasing the Range of Students Served

The satisfaction with the project expressed by VHS students, teachers, and administrators was tied to the fact that the project offered elective courses that teachers otherwise could not teach and students otherwise could not take. Clearly, VHS has

found an important niche for itself. However, the current VHS curriculum is dominated by advanced courses that cater to students who are successful, independent, and college bound. Although such courses were an important service for those who participated in the program, this focus limits the impact of the project to a narrow range of homogeneous students and works against the goal of the project to equitably address the needs of a diverse group of students. Indeed, the survey results document that VHS students do not represent the full range of students in participating schools.

There is a clear need for VHS staff to create other models of course offerings that address certain needs of schools and students (beyond those that can be addressed within normal school programs and budgets). For example, the original VHS proposal identified a need for vocational courses that typically cannot be offered within a single school, because of the likelihood of low enrollments. Networked computers have the potential to reach a much broader and diverse group of schools and students than those involved to date. Currently, for example, there are few VHS schools from rural areas; yet these schools are often ones that have the most difficulty offering a full range of courses. The VHS project would be a significant benefit to these school districts.

Within and across school districts, there are also a variety of students whose special needs could be addressed by VHS, when the local resources otherwise might not be sufficient to extend beyond the core curriculum. The home-bound, home schoolers, and students in juvenile detention might all benefit from on-line courses that otherwise would not be available to them. Corporate-sponsored, resident internships coupled with technical courses offered at a distance could create additional resources that increase project efficiency and extend the program's services to students who are not college oriented. By creating and offering additional models of course offerings and instructional arrangements, VHS could significantly increase the diversity of its student body and broaden its impact.

Sustainability and Scaling Up

The VHS program clearly requires more time and resources than teachers and administrators expected. VHS courses also have lower enrollments than traditional courses. In addition, the coordinator's role is a special and important one that represents necessary resources beyond those required of traditional courses. Even though administrators feel that these additional expenses are justified, there are limitations on the extent to which participating schools will continue supporting VHS after external funding is discontinued. There may also be limitations for other schools that might be reluctant to

start up the project without additional funding to cover the initial extra effort to get it started.

Currently, only 57% of the superintendents said they would continue the project after outside funding was discontinued. A primary concern of superintendents is the project's cost-effectiveness, or the "bang for the buck," as one assistant superintendent put it during a case study visit. She went on to say, "It is not a cost-effective program at this time. It's just the opposite. It has cost us a great deal of money for a small amount of students who have benefited."

There seem to be two interrelated components to this concern: the narrow impact of the project and its costs, relative to traditional course offerings. The assistant superintendent quoted above raised her concern within the context of VHS's college-oriented course offerings, which she valued. However, she went on to say that there might be other, less expensive ways to address their need for advanced electives. Colleges and universities are dramatically increasing their on-line course offerings (National Center for Education Statistics, 1996). Such college-level programs offer not only a wide range of advanced courses but the prospect of advanced-placement college credit. The assistant superintendent wondered, "Why would [students] take a VHS course if [they] can take a college course?"

Within this context, even the currently successful model of college-oriented VHS course offerings is at risk. To sustain this model, the VHS staff may need to find ways to connect the project to college or university distance learning programs. "Current Issues in Nutrition and Health," a course offered by Framingham State College, may serve as a model for this collaboration. Such arrangements could provide an even wider selection of advanced courses for college-bound students than VHS can currently manage. In fact, such courses could offer college credit. In addition, such arrangements may reduce the costs of the VHS project. Participating colleges may be motivated by the recruitment of new students or the generation of tuition that could be charged for college credit given to VHS students. These institutions may not need the reciprocal enrollment slots for their own students. This situation would create a surplus of slots for VHS that the program could allocate to participating high schools, thus reducing the per-pupil costs to the schools and increasing the efficiency of the project.

Other arrangements that reduce costs could also contribute to sustainability and scalability of the project. These might include corporate-sponsored courses, or programs or volunteer course offerings by retired teachers, that could also increase the pool of

enrollment slots and allow the schools to “buy” more placements in trade for the courses that they offer. Alternatively, class sizes could be increased through the use of college students or preservice teachers as volunteer teaching assistants. This additional help might increase the number of students a VHS teacher could manage in a single course. It could also serve as an on-line apprenticeship for aspiring teachers.

There is another component of the VHS model that must be reviewed if sustainability and scalability are to be assured: the site coordinator. Evidence suggests that this role is crucial to the project’s success, yet it is one of the most expensive elements of the project and one that is, perhaps, least scalable as the numbers of courses and students within a school increase.

As mentioned earlier, some aspects of the site coordinator’s role are more administrative: recruiting teachers and students, and coordinating with local administrators and VHS staff, for example. This is a relatively modest overhead cost that is not likely to increase significantly, as the program scales up within a school. A single person can probably handle program promotion, the recruitment of a relatively large number of local students, and administration of locally offered courses.

On the other hand, student monitoring and coordination seems to be an important but much more time-consuming part of the coordinator’s role. Students in case study schools seemed more satisfied in schools where the site coordinators were more involved in student monitoring and support. Yet, this is the part of the coordinator’s role that can become problematic as funding is discontinued or the program is scaled up. The cost demands of the VHS program are modest if the trade between providing a teacher and receiving a number of student slots is nearly even, because the services being provided and received are nearly equivalent. However, if in addition to a distant teacher, local VHS students require significant assistance from a local staff person (i.e., the site coordinator), the costs of the program rise significantly. In effect, a VHS course takes two teachers, and the costs are doubled.

Furthermore, this aspect of the site coordinator’s role has limited scalability. As the numbers of students, teachers, and courses increase, a single person will have difficulty monitoring students, knowing the requirements of each of the courses that they take, and communicating with the many teachers of these courses. Indeed, the current level of effort seems to be the limit of the time available to site coordinators. Coordinators in three of the five case study schools indicated that it would be difficult for them to do their job if their schools offered more VHS courses or more students in their schools enrolled in

VHS courses. In responding to the end-of-year survey, coordinators uniformly said that an increased number of students would take significantly more time, under the current structure.

Structuring an economically sustainable and scalable role for the site coordinator will be a significant near-term task for the VHS program. This may require the VHS teachers to take more responsibility for monitoring and maintaining the progress of their students. Although VHS teachers were reluctant to “babysit” the students in their own schools who were taking other VHS courses, if they could develop strategies for maintaining more communication with and monitoring the progress of their own VHS students, the burden on the coordinator would be reduced. One coordinator pointed out that by creating many small assignments that were given frequently, one teacher was able to keep all of her students current in her course. If VHS teachers used this and other strategies regularly with their own VHS students, it would reduce the need for coordinators to spend large amounts of time monitoring students in their home schools. Alternatively, if students could spend on-line time with volunteer college mentors, it is likely that they would maintain progress in their courses and reduce the need for face-to-face supervision from coordinators.

REFERENCES

- Harasim, L., Hiltz, S., Teles, L., & Turoff, M. (1995). *Learning networks: A field guide to teaching and learning online*. Cambridge, MA: MIT Press.
- Harasim, L., & Yung, B. (1993). *Teaching and learning on the Internet*. Burnaby, BC: Department of Communication, Simon Fraser University.
- Hiltz, S. (1995). *The virtual classroom: Learning without limits via computer network*. Norwood, NJ: Ablex.
- Johansen, R., Martin, A., Mittman, R., & Saffo, P. (1991). *Leading business teams: How teams can use technology and group process tools to enhance performance*. Reading, MA: Addison-Wesley.
- Kozma, R., & Schank, P. (1998). Connecting with the 21st century: Technology in support of educational reform. In C. Dede (Ed.), *1998 ASCD year book: Learning with technology*. Alexandria, VA: Association for Supervision and Curriculum Development.
- McIsaac, M., & Gunawardena, C. (1996). Distance education. In D. Jonassen (Ed.), *Handbook of research for educational communications and technology*, pp. 403-437. New York: Macmillan.
- Means, B., & Olson, K. (1995). *Restructuring schools with technology: Challenges and strategies*. Menlo Park, CA: SRI International.
- National Center for Education Statistics. (1995). *Schools and staffing survey: 1993-94 electronic codebook and public use data (CD-ROM)*. Washington, DC: U.S. Department of Education.
- National Center for Education Statistics. (1996). *Digest of education statistics*. Washington, DC: U.S. Department of Education.
- President's Committee of Advisors on Science and Technology, Panel on Educational Technology. (1997). *Report to the President on the use of technology to strengthen K-12 education in the United States*. Washington, DC: Executive Office of the President.
- U.S. Department of Education. (1996). *Getting America's students ready for the 21st century: Meeting the technological literacy challenge*. Washington, DC: Author.

Appendix A
METHODOLOGY

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The Virtual High School evaluation is a multi-year longitudinal study of the Virtual High School (VHS) project. The evaluation design is goals-based, measuring the extent to which the program has attained clear and specific objectives. Although such a design focuses primarily on the intended outcomes of the program, the evaluation also reports on outcomes that were not specifically addressed or anticipated in the original evaluation plan.

Data collection methods include surveys, case studies, reviews of documents, and interviews with VHS consortium staff. The principal data sources are surveys of VHS participants and case studies of five selected VHS schools.

Surveys

Four baseline surveys were conducted in the fall of 1997. The evaluation team mailed surveys to all the district superintendents (in districts with at least one VHS site), VHS school principals, coordinators in the VHS schools, and VHS teachers. In the spring of 1998, toward the end of the first school year of VHS's operation, SRI surveyed these four groups again. The response rate for each of these eight surveys was about 85%. (Table A-1 shows the response rates for the second set of surveys.)

In addition, VHS central staff conducted on-line surveys of VHS students at the end of each school semester during the 1997-98 school year. The response rate for the fall survey was too low to provide statistically reliable data (therefore, the data were not used in this report). The response rate for the spring survey was about 81%, as shown in Table A-1.

**Table A-1
Response Rates on 1998 VHS Surveys**

	Superintendents	Principals	Coordinators	Teachers	Students
Universe	23	26	26	33	373
Returned	20	22	23	28	301
Response rate	87.0%	84.6%	88.5%	84.8%	80.7%

Case studies

Case studies were developed for five VHS sites. The sites were selected to provide a wide variation across regions and school types (e.g., rural vs. urban, more and less wealthy, etc.). Table A-2 presents characteristics of the case study schools along several dimensions that influenced the selection of the sites.

For the most part, these case studies were based on information from two site visits (fall and spring) to each VHS school by the same SRI researcher. During the first site visit, toward the end of the first semester in the fall of 1997, at least one member of the evaluation team visited each of the schools and interviewed the principal, the superintendent of the school district, the VHS coordinator, and the VHS teacher(s) at the school. SRI researchers also conducted focus groups of VHS students at each case study school.

In the spring of 1998, SRI researchers conducted a second site visit to the same five VHS schools that had been visited in the fall. Again, the evaluators interviewed the principals, VHS coordinators, VHS teachers, and the corresponding district superintendents. They also convened another focus group of VHS students at each school.

A case study was written for each school, based on the two visits conducted at each site. From the five case study reports, SRI researchers developed a cross-case analysis of major issues and findings. The cross-case analysis and the survey data were key sources of information for this report.

**Table A-2
School Sample for VHS Case Studies**

School	State	Poverty	Diversity	Size	VHS Course and Type	VHS Fall '97 Enrollment *
Kennedy	CA	About 25% on free/reduced-price lunch program <\$5,000 per-pupil expenditure (ppe)	53.4% minority	1,501 (9-12) District: 29,000	Poetics and Poetry for Publication (Adv)	School: 23 Course: 18
Miramonte	CA	About 10% on free/reduced- price lunch program >\$7,000 ppe	20% minority	1,092 (9-12) District: 4,200	1. Russian, Soviet, & Post-Soviet Studies (Adv) 2. Economics & the Budget (Inv)	School: 27 Course: 11 in Russian studies; (Econ in Spr only)
Westborough	MA	>\$7,500 ppe	8% minority	603 (9-12) District: 2,400	1. Bioethics Symposium (Adv; co-taught) 2. Music Appreciation (Inv; co-taught)	School: 25 Courses: 20, 19
New Hanover	NC	About 18% free/reduced-price lunch program ~ \$4,500 ppe	36% minority	1,585 (9-12) District: 20,400	Computer Technology I (Tech)	School: 15 Course: 19
Allen	TX	Very low on free/reduced-price lunch program \$4,300 ppe	8% minority	1,700 (10-12) District: 8,700	1. Earth 2525: A Time Traveler's Guide (Inv) 2. Explorando Culturas Hispanas (Lang)	School: 32 Courses: 13, 10

Course types: Adv = advanced; Inv = innovative, academic; Tech = technology; Lang = language

* Enrollments reflect figures that were reported at the beginning of the fall semester. School enrollment numbers are local students enrolled in VHS courses.