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A Scalable Model of Collaborative Learning: The Virtual High School Cooperative

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- [Introduction - The Netseminar & NetCourse Model](#)
 - [Properties of NetCourses](#)
- [Preparing Teachers for NetCourses: The Teachers Learning Conference](#)
 - [Participants: Students, Teachers, Site Coordinators & Netfaculty](#)
 - [Technology Tools and Infrastructure](#)
 - [Structuring Discussion Groups & Moderation](#)
- [Progress Report](#)
 - [Teacher Concerns about the NetCourse Model](#)
 - [Faculty Views of Netseminar Experiences](#)
- [Iterative Design of the TLC Netseminar and NetCourse Model](#)
- [Summary](#)
- [Author's Addresses](#)



- A PDF file is also available of entire article: [[.PDF, 15 pp., 115K](#)]

Abstract

Can NetCourses^(TM) teach collaboration, improve learning, and transform teaching practices on a large scale? This paper describes an experimental model of collaborative Web-teaching using netseminars to train teachers, who in turn, create NetCourses for their virtual students in a Virtual High School (VHS) Cooperative. We suggest that netseminars and NetCourses represent a viable and feasible method for scaling up instruction that fosters constructivist teaching practices and capitalizes on collaborative learning communities and cooperative on-line resources. We articulate this novel model and discuss issues in fostering collaboration, highlighting the challenges faced by teachers and netfaculty in the transformation of their practices toward collaborative approaches based on results from the first netseminar. We raise questions about the cultural shifts needed to transform computer-supported collaborative teaching and reflect on redefinition of teacher/student roles in the scaling of electronic communities.

Keywords --distance education, NetCourses^(TM), research in technologically-mediated

communication, education reform

Introduction - The Netseminar & NetCourse Model

The Virtual High School (VHS) Cooperative Project represents the first large-scale experiment in applying collaborative network technology to deliver rigorous precollege courses over the Internet (see <http://vhs.concord.org>). Specifically, this project tests a collaborative model of virtual instruction through NetCourses and netseminars (Tinker & Haavind, 1996). NetCourses are courses of study that are offered using the Internet as a main way to share information, carry out discussions, and assess student learning. This project explores 1) the feasibility of creating of strong partnerships and communities between teachers, school administrators, technologists, and content experts through collaborative technologies, 2) the scalability and replicability of these electronic communities to support secondary school instruction and 3) the promotion of constructivist teaching practices toward global education reform. This paper reports on issues encountered in the first trial of the netseminar model, one of five netseminars to be delivered over the next three years.

Several science & mathematics networking projects and virtual instructional environments have influenced the design of the NetCourse model (Harris, 1994; Harasim et al., 1995; Hiltz, 1994; NTEN, 1995). The basic model of the VHS NetCourse involves one teacher and 20 students in a teaching cooperative. Each school in the cooperative contributes at least 20% FTE of a single teacher's time to develop and teach an Internet-based course. Schools also donate computers, Internet connectivity, and staff time. Each school must provide a VHS site coordinator who is responsible for VHS project management and support of teachers and students at their local school. The VHS grant provides financial support for the site coordinator as well as training, software, and technical support. Each school in the cooperative can enroll 20 students to take NetCourses for each period of a teacher's time they contribute to the pool. Quality of teaching is maintained by requiring each teacher to successfully complete a graduate-level NetCourse, "The Teachers Learning Conference", on the design and development of networked-based courses, including instruction in constructivist learning theories and collaborative learning approaches.

This design creates a low-cost means of vastly augmenting the range of courses a school can offer without expanding enrollment. In exchange for contributing a small amount of teaching time to the cooperative, a school will be able to offer its students NetCourses ranging from advanced academic courses and innovative core courses, to technical course electives and specialized courses for language minority students. The resulting flexibility will greatly help schools match their teaching talent to the needs of students. Moreover, as schools contribute more teaching time, they can enroll correspondingly more students, and create more NetCourses to be shared among all of the schools. In this manner, the VHS cooperative can grow smoothly and with a minimum of extra funding.

[\[top\]](#)

Properties of NetCourses

NetCourses share the same properties of other virtual instruction that make them particularly valuable as a mechanism for learning. All course materials and activities are available electronically and can be accessed in shared electronic spaces: course syllabus, materials, class discussions, assignments, answers to questions, help on assignments, and faculty office hours. NetCourses are asynchronous: students can enter the discussion at anytime and spend more time reflecting on their contributions. Instruction is also geographically independent. For example, students in small rural areas can take a course not offered in their own school, and teachers can offer a course to a broader diversity of students even if only two students from

their home school are interested in enrolling. NetCourses offer opportunities for larger access to peers and experts for group collaboration, peer critique, and teacher collaboration.

What makes the NetCourse model unique? Many new learning strategies become economically feasible through NetCourses that can scale to larger audiences. For example, faculty that teach courses can include master teachers, disciplinary experts, and experienced professional developers. Teachers have potentially more opportunities for sharing information with other teachers, while helping reduce isolation and build knowledge-sharing teaching communities.

The same advantages of NetCourses might also be disadvantages, especially for teachers new to collaborative approaches and collaborative technologies. The design characteristics of NetCourses such as being technology-rich, lacking face-to-face communication, and hands-on might result in anxiety and skepticism in computer-supported approaches. Asynchronous learning can mislead users to think that there is more instructional time for students rather than a use of "different time."

Moreover, a technology-rich environment might provide more hands-on opportunities for teachers to use technology, yet they may not change their teaching practices toward deeper student inquiry. Teachers who rely on humor, gestures, inflection, prosody, or other aspects of face-to-face contact to engage and monitor student progress might require redefining their instructional practice to be an effective virtual teacher. The idealized model of student-centered learning mediated by a computer may in fact lead students to flounder, teachers to over dictate assignments, eliminate hands-on learning, or favor a small group a technology-savvy students in discussions.

What will be the new role of teachers as they design virtual interactions and instruction for their virtual students? How will teachers' instructional styles change when a former course becomes a NetCourse? What is the role of netfaculty in supporting teachers' transformation of practice? Will NetCourses facilitate teachers to collaborate with other virtual teachers, administrators, technologists, content experts, and other members of an electronic community? These questions were the focus of investigation during the first netseminar for teachers. The first seminar for teachers provided an entry point towards answering these broader questions.

[\[top\]](#)

Preparing Teachers for NetCourses: The Teachers Learning Conference

The first netseminar called the Teachers Learning Conference (TLC) began in March of 1997 (<http://vhs.concord.org/tlc/1997mar/>). This 18 week-long netseminar was fashioned after a graduate seminar rather than a lecture course. The teachers attending the netseminar were exposed to a broad repertoire of educational strategies, virtual teaching techniques, and current developments in their discipline. The netseminar espoused a learning-by-scaffolded apprenticeship model: teachers experienced first-hand a virtual education that included moderating large and small group discussions, searching digital libraries, downloading and printing electronic documents, creating shared knowledge spaces, and other activities which they could practice with assistance, then use independently in their own NetCourses. The tangible products of the netseminar are NetCourses offered as the Virtual High School curricula. The first set of NetCourses were delivered in the Fall of 1997.

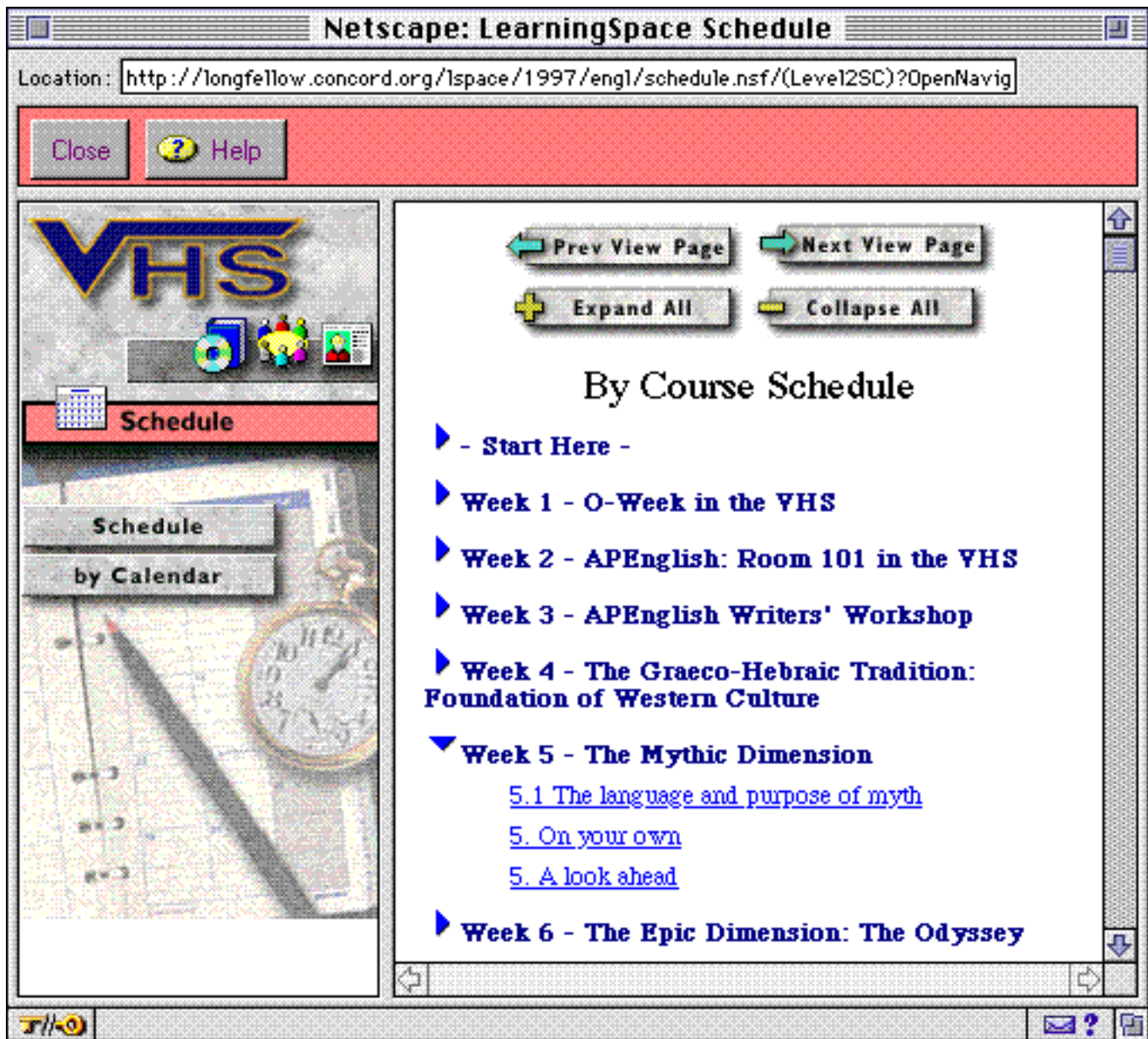


FIGURE 1: A view of the Course Schedule database in LearningSpace^(TM) from a VHS NetCourse.

[\[top\]](#)

Participants: Students, Teachers, Site Coordinators & Netfaculty

27 high school teachers from 13 states participated in the first Teacher Learning Conference. Teachers ranged from recently credentialed teachers to 25+ year teaching veterans. Compared to national averages, many of these teachers held master's degree and had previous experience creating new courses (See Zucker et al., 1997). Each teacher participating in the seminar was required to partner with a local site coordinator, technology coordinator, or school administrator. This constraint in the NetCourse design was deliberately created to help

Conference, however, they were not required to complete course assignments.

Seven faculty members, half co-located in Massachusetts and half geographically distant from each other, shared the responsibility for facilitation the TLC. Netfaculty, using bi-weekly phone meetings, email, and the Web, constructed an on-line course syllabus. Pairs of faculty teamed to design weekly Web readings and activities, and rotated leadership responsibility for moderating the main teacher discussion.



FIGURE 2: A view of the Media Center database from a Teachers Learning Conference.

[\[top\]](#)

Technology Tools and Infrastructure

LearningSpace^(TM) is a set of five specialized, interactive databases which provide tools for the creation and delivery of on-line courses (see <http://www.lotus.com/products/learningspace.nsf>): Course Schedule, Profiles, Media Center,

CourseRoom, and Assessment. The Course Schedule allows students to see agendas, assignments with various due dates, and access links to other databases in LearningSpace (Figure 1). The Profiles database lists all the participants in the discussion including a digital photos of participants and their contact information. The MediaCenter includes links to any documents on the World Wide Web as specified by the teacher, as well as any links to specially designed documents within LearningSpace (Figure 2). The CourseRoom is similar to a standard threaded discussion tools, however, it permits categorization of comments, as well as local text and graphics documents to be attached. The Assessment database, accessible to teachers only through Lotus Notes, teachers to create tests, manage students' progress on assignments, and assign grades.

[\[top\]](#)

Structuring Discussion Groups & Moderation

Teachers and site coordinators in the netseminar were initially addressed as a whole group in electronic discussion. This served to build community at the start of the course. By week 4, participants were divided into three smaller groups of 12-13 which were moderated by a pairs of faculty. Teachers also had opportunities to practice their discussion moderation skills in these groups. At this time, two additional discussion spaces were created called the "Water Cooler" and "Go Ask Alice" for purposes of socialization and receiving answers to specific technical issues around hardware and software use. By the 10th week of the course, teachers were divided into even smaller groups of 3-5. Each group was mentored by a designated faculty member. Faculty members used a combination of e-mail, telephone, and Web-based discussion to mentor teachers during the critical period of NetCourse creation in LearningSpace^(TM). Various group sizes and communication methods allowed teachers in the netseminar to test their electronic communication skills while also experience different levels of intimacy in sharing and critique ideas with others. Moreover, individual progress could be more easily monitored by individual faculty in small groups.

[\[top\]](#)

Progress Report

Formative evaluation of the netseminar model is on-going as the Virtual High School project grant will continue until October 2001. As of September 1997, 28 schools and 32 teachers, have joined the Virtual High School Cooperative. Site coordinators have also enlisted to support teachers in administrative and technology issues. The fall semester welcomed 550 virtual students who were taking a selection from 28 different courses. A selected sample of course titles are provided in Table 1.

Several key concerns emerged during the first TLC expressed by teachers in training, as well as netfaculty conducting the netseminar. These concerns are compiled from a pre and post surveys, collective virtual faculty observations of teacher-to-teacher interactions, and discussion comments from TLC netseminar.

[\[top\]](#)

Teacher Concerns about the NetCourse Model

Teachers written comments from the pre survey were compiled and themes were identified using an ethnographic approach method similar to semantic domain analyses (Spradley, 1979).

The most prevalent theme expressed by teachers was concern over the lack of face-to-face contact with students in NetCourses and recognizing the need to develop new approaches to establish rapport with students. They feared instruction would be less engaging and monitoring student responses more difficult.

"One of my strengths in teaching has been whole group instruction and creating a sense of community within the class. So much of that dynamic, however, is environmental---classroom decor, ambiance, and subtle non-verbal communication between students and students, students and myself. I am looking forward to the challenge of trying to bring about that same sense of community in the virtual environment."

"It will frustrate the hell out of me because, like most teachers, I'm a natural ham that counts on the strength of my rapport with students to help learning work."

Although some teachers perceive the lack of face-to-face contact a disadvantage, other teachers viewed this as a strength of the virtual medium. Teachers believed netseminars could greatly improve teacher-to-student contact in NetCourses, however, teachers did not perceive the virtual environment to increase student-to-student contact. This suggests teachers need more guidance in learning about designing collaborative and peer-assisted approaches in NetCourses. One teacher believed that virtual environments removed the need to discipline students because of the kinds of students NetCourses would attract. Many teachers predict that only those students who demonstrate autonomy in learning will benefit most from NetCourses. Teachers fear that students who do not already assume responsibility for their own learning might have difficulty accepting this new autonomous role.

"A student will need to assume responsibility for learning and will need to ask questions and seek help when needed. Some students may have difficulty accepting this role."

"Communication with students will be very different. Face-to-face interaction is replaced with the typed interaction. It's bound to be different...maybe more difficult. Students will be required to assume more responsibility for their learning. That may be good. That may be extremely difficult for some."

Many teachers also expressed anxiety about the time required to participate in netseminar activities, and projected this concern to time required to teach their future NetCourses. Teachers not only had to be versed in content, but also in web activity design, technology troubleshooting, electronic moderation, virtual assessment and grading, and communication with students. Some questions that plagued teachers include the following: How will I fairly assess participation? How do I conduct hands-on activities with virtual students? How do I meet national standards with my course? Although teachers posed and discussed cognitive and pedagogical issues, many logistical concerns about using networked technologies also dominated the discussion. What kinds of activities should be planned if the network goes down? How do I conduct class and plan assignments when other schools are on break at different times? Should I deliver hardcopy curricular materials to my students? We considered both of these kinds of questions productive for teachers to reflect upon as they defined their new instructional practices in NetCourses, for site coordinators in administering NetCourses, as well as for researchers refining the NetCourse model.

Overall, teachers expressed excitement about the Virtual High School collaboration and were highly enthusiastic about meeting and working other teachers. When teachers were asked whether their technology could improve student understanding, only 62% of the teachers concurred indicating a healthy skepticism about the role it could play.

"It will be interesting to see if this technology will be a help or a hindrance to the learning process. Like many other teaching techniques, I think some students will excel

via this method, some will do the same as with conventional methods, and some will do worse."

[\[top\]](#)

Faculty Views of Netseminar Experiences

Netfaculty, all of whom have had prior experiences teaching in face-to-face courses, as well as utilizing the Web to support aspects of their own teaching and university-level courses, shared many of the similar concerns in the process of conducting the TLC netseminar. Although the electronic format of the netseminar made it possible to log user interactions and document all discussion comments and written assignments, motivating participation from all teachers was difficult. The asynchronous format and lack of face-to-face visibility of students made it easy for teachers to "hide". Although there was a clear goal, expectations, and timeline for response as prescribed by Riel & Levin (1990), not all teachers participated actively and nor regularly.

This lack of participation in a virtual medium could be attributed to many issues such as technology difficulties, lack of interest, time issues, or inhibitions in expressing oneself in an on-line community. In the case of TLC, teachers reported finding time for discussion difficult during the semester while teaching other courses, as well as technical difficulties with accessing the main server via LearningSpace from their local machine and particular configuration. One consistently absent teacher reported that she didn't see the course discussions as a necessary part in accomplishing her NetCourse and also admitted she worked better alone. Faculty, challenged with cases like this, anticipated teacher difficulties with utilizing discussion effectively as a medium for learning, communicating, and monitoring student understanding in his or her own course, as well as capitalizing on peer supports only available in the virtual medium. A constant tension faced by netfaculty was striking a balance between providing prescriptive guidance in both constructivist teaching practices and virtual approaches to instruction, while respecting teachers' preferences and individual teaching styles.

Several different size discussion groups were organized to help fuel discussion and specifically meet the needs of teachers at different points in the course. At the TLC start with the large group, it was hard to monitor which teachers were not participating. Discussion threads became long and cumbersome to navigate. In groups of 12-13, some groups collaborated extremely well making thoughtful contributions, while others only had 2-3 participants in a single week. Our shared experiences, also validated by discussion logs, suggest that both gaining critical mass of highly interactive participants and strong facilitation skills are critical factors in sustaining a successful discussion. Although the small groups of 2-3 were designed to foster peer collaboration among teachers, many teachers chose communication via email one-to-one with faculty, or using the telephone, not choosing to share their instructional design issues with others in their group. While faculty agree that a dividing participants into smaller groups was a good idea, they disagreed on what size was most effective for supporting on-going communication with teachers. The small groups relied on regularly active participants and frequent facilitation to maintain a good discussion, but other groups which were well facilitated had little or no participation. More post-hoc analyses of data and on-line experiences in this learning context will help clarify this netseminar design issue.

Faculty also were concerned with the grading criteria of teachers, designing assignments that would be meaningful, interactive, and reflective rather than simply reading and posting electronic documents. As netfaculty, how should teachers be encouraged to reform their current teaching practices? In several cases, faculty observed NetCourse outlines created by teachers-in-training mirroring didactic teaching approaches. The assignments they created for students involved posting a reading, and having homework sent back, graded and seen only by the teacher. Initially, few teachers created group assignments and activities that capitalized

on sharing or publishing information, peer critique, and peer assessment. In other instances, teachers were in fact duplicating real courses and materials into the virtual environment despite facilitated discussions and readings on constructivist learning, examples of student-centered inquiry, and activities designed to foster collaborative learning among teachers. Because there were also many superb NetCourse activities created by fellow teachers, these could be used to help anchor discussion and serve as exemplary models for NetCourse designs. Faculty were challenged with defining their own roles as virtual instructors, providing facilitation that limited direct 'knowledge-telling' (although easy to do) and permitted teachers to discover and define their own courses.

[\[top\]](#)

Iterative Design of the TLC Netseminar and NetCourse Model

The goal of the Teachers Learning Conference was to prepare teachers to teach in the virtual NetCourse model, while also encouraging teachers to develop new student-centered curricular activities and virtual instructional practices. Results from a post survey given at the end of the 18-week long Teacher Learning Conference helped provide some insight for future revisions. These results are drawn from about half of the teachers who provided feedback.

Responses from the post survey indicate that overall, the netseminar was successful, especially for demonstrating "new ways to teach." Although the syllabus included a balance of academic readings, activities, and discussion on technology, NetCourse design, instructional theory and practice, teachers requested more concrete training using the LearningSpace environment. Of the syllabi topics offered, teachers rated those weeks on creating their course in LearningSpace the highest and most useful, compared to other topics such as community building, discussion moderation, graphics/multimedia, education reform, assessment, and networked resources. This pragmatic stance was also consistent with the kinds of on-line discussion teachers found useful. Overall, "Go Ask Alice" where teachers could get technical support, was rated their favorite discussion space.

Despite faculty efforts to encourage virtual practices, teachers wanted more paper-based tutorials and documentation on authoring in LearningSpace beyond the on-line help provided by the system. (No commercial documentation is currently available.) Although custom-designed user documentation on LearningSpace was created for this purpose, teachers with persistent technology challenges could not take advantage of this. Researchers recognize the need to maintain duplicate hardcopies of materials to meet individual teacher preferences, especially during technology and networking failures.

TABLE 1: Sample NetCourse Offerings from the Virtual High School Cooperative

La Connection Francophone
Earth 2525: A Time Traveler's Guide to Planet Earth
Explorando Varios Aspectos de Culturas Hispanas Atraves del internet
AP English: A Web based course in Literature & Composition
Bioethics Symposium: Investigating the Biological Revolution
A Model United Nations Simulation using the Internet
AP Statistics
Eastern & Western Thought: A Comparison
The Native Experience
Folklore and Literature of Myth, Magic, and Ritual
Business in the 21st Century

For accomplishing their courses, teachers found one-to-one email with netfaculty the most effective method of communication (55%) followed by the 12-13 person discussion groups (22%) and face to face meetings with site coordinators and, in few cases, co-teachers at the same location (17%). A handful of teachers with productive face-to-face collaborations with another on-site teacher or site coordinator provided "proof of concept" for the partnerships envisioned in the NetCourse model. However, this was not the norm. Most teachers preferred one-to-one communication with the VHS project coordinator or faculty (typically via email) rather than communicating with their own site coordinators or fellow virtual teachers. Researchers need to continue the study of collaboration, virtual or face-to-face, in the social context of a virtual school.

While teachers spent, on the average, a majority of their time on course design, they also wanted to spend less time troubleshooting technology failures and school administration issues (2-3+ hours per week). This also suggests that the roles of local teachers and site coordinators, and their level of collaboration is an area of needed improvement in the current NetCourse model.

[\[top\]](#)

Summary

In summary, teachers, site coordinators, school administrators, and faculty are highly enthusiastic about the NetCourse concept. The netseminar has been, so far, successful in

plan alone is normative practice.

Experimental research with NetCourses as a model of scalable instruction is in its early stages. Future experiences will help to contribute to the knowledge of computer-supported collaborative learning, not only as test-bed for new collaborative technologies, but towards a design science for informing us about educational practice, reform, and new possibilities for networked learning.

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[\[top\]](#)

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