Netcourses and Netseminars: Current Practice and New Designs

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**Abstract**

Netcourses – courses delivered primarily over digital networks – promise to provide learners with quality, low-cost learning opportunities anywhere and anytime. While having implications throughout education, adult professionals may be the first to make extensive use of netcourses. By increasing the quality and timeliness of teacher professional development while reducing its costs, netcourses could have a major impact on the quality of teaching. In order to understand the realities of this promise, we have reviewed in detail all netcourses for teachers in mathematics and science. As a result of this analysis, we have developed new designs for the effective use of this medium with mathematics and science teachers.

**The Potential of Netcourses**

To date, the educational uses of networking have given educators new resources that are valuable but limited in scope. Network collaborations, mentoring programs, access to supercomputers and instruments and, of course, access to the decentralized resources on the Internet, have enriched education. With few exceptions, however, these resources have simply been added to conventional courses taught in conventional settings. We ask whether networking allows us to reconsider the larger teaching context and move instruction itself onto the net.

Courses that are offered over the network represent one of the most promising current developments in education. In this section, we define our terms, sketch out the advantages of netcourses, highlight the differences between conventional and network-based courses, and use this analysis to predict the early emergence of netcourses for professional development of teachers.

**Definitions**

There are no agreed-upon terms to refer to instructional activities that rely primarily on faculty-structured learning over digital networks; while we prefer “netcourses,” while others have used the term “online education” (Harasim, 1990), the “online classroom” (Berge & Collins, 1995) or “telecourses” (Vogeli, 1995).

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Riel and Harasim (1994) provide a useful definition of the characteristics of courses using digital networks:

In this model, all course activity occurs on-line, using computer conferencing or bulletin board systems, or, in a few cases, using e-mail interaction. On-line class activity resembles face-to-face classes in many ways: A teacher typically organizes the material, describes the sequence, establishes the pace, and determines the readings and other assignments. However, on-line courses are asynchronous and place-independent; students may live in different cities or even different countries from one another and the instructor. In on-line courses, students read the course materials, then log on to participate in on-line seminars, large and small group discussions, and individual or group projects. Face-to-face meetings do not occur or are optional.

(p. 95)

It is important to distinguish between kinds of netcourses, ways of using networks for education, and other forms of “distance education.” Generic netcourses rely primarily on networks, whereas a special sub-set of netcourses that we call “netseminars” utilize on-line discussion groups such as those described by Riel and Harasim. It is not necessary that a netcourse utilize seminar-like on-line discussions, but this appears to be the best instructional use of the medium.

Netcourses are a form of distance education but the latter term has become synonymous with either two-way video or live video broadcasts with real-time telephone back to the studio. These high-bandwidth approaches to distance learning are synchronous, relatively expensive, and do not easily support reflective thought and collaboration. Real-time interactions require synchronization that discourages reflection and is difficult across time zones. In contrast, netcourses, do not rely primarily on live video or simultaneous two-way communications although they might employ these technologies.

Advantages

Netcourses have a number of important properties that make them particularly valuable as a mechanism for any kind of learning:

Any time. A participant can use the network at any convenient time: early morning, late night, after work, or on weekends. The episodes can be quick snatches at odd times or long late-night sessions. Emergencies, unscheduled interruptions, or odd vacations, do not interfere. Conversations do not have to be scheduled. Cross-time-zone communication, difficult to arrange in real time, is as easy as talking to someone across town.

Any place. The participants do not have to meet. That means they can be anywhere. Native Americans in Alaska can collaborate with their peers in New York City. International sharing is feasible. Individuals can log on at work, home, the library, or from their hotel when traveling.

Asynchronous interaction. Unlike face-to-face or telephone conversations, electronic mail does not require participants to respond immediately. As a result, interactions can be more succinct and to-the-point, discussion can stay
more on-track, and people can get a chance to craft their responses. This can lead to more thoughtful and creative conversations.

**Group collaboration.** Electronic messaging creates new opportunities for groups to work together, creating shared electronic conversations that can be thoughtful and more permanent than voice conversations. Sometimes aided by on-line “moderators” these “netseminars” can be powerful learning and problem-solving environments that can leave a permanent legacy (Grief & Sarin, 1986; Winograd, 1988; Kraut, et al, 1988).

**New educational approaches.** Many new options and learning strategies become economically feasible through netcourses. For instance, the technology makes it feasible to utilize faculty anywhere in the world and to put together faculty teams that include master teachers, researchers, scientists, and experienced professional developers. Netcourses also can provide unique opportunities for teachers to share innovations in their own work with the immediate support of electronic groups and expert faculty.

**Integration of computers.** The netcourse learner has access to a computer, so computer applications can be used without excluding some participants. This means, for instance, that a mathematical model implemented in a spreadsheet can easily be incorporated into a lesson and downloaded so all participants can run, explore, and refine the model and then share their findings and improvements.

**Differences**

Asynchronous communication using computers is a substantially different medium from face-to-face conversation and, therefore, it is inappropriate to simply transfer into this new medium the techniques and institutions that have developed around lectures and textbooks. When applied to instruction, the distinctive nature of netcourses need to be considered and designs developed that rely on the strength of the medium and minimize its weaknesses.

Many find network-based asynchronous communications constraining and awkward; it certainly lacks non-verbal clues as well as the rapid back-and-forth of verbal conversation between familiar partners. It is natural to assume that asynchronicity is a temporary limitation that will go away when bandwidth costs drop and we can rely on the more familiar synchronous interactions using voice and video. Yet, as anyone who has tried to schedule a meeting or conference call realizes, synchronicity can be difficult to realize. Because of these scheduling problems, as well as the difficulty of reflection in real time, synchronous networking will have at best only a supporting role in netcourses.

Asynchronous learning offers so much in terms of convenience, thoughtfulness, long-distance collaboration, and quality that its problems are, in some applications, outweighed by its advantages. The shortcomings introduced by asynchronicity will become less pronounced as the technology improves, as users become more adept in
its use, and as hybrid approaches are developed that depend on multiple forms of communication.

**A Study of Current Practice**

As effective netcourse designs and technologies are evolving, the first users will be learners who can tolerate the present limited expressiveness of the medium and who need inexpensive courses. This would seem to favor adult professionals who are comfortable with text who value the cost savings, especially teachers. Thus, we predict teachers will be early adopters of netcourses for professional development. As our experience is in mathematics and science education, we were particularly interested in exploring the applications of netcourses for teachers in these areas.

In order to understand whether netcourses really can have the impact on teacher professional development (TPD) in mathematics and science of which they appear to be capable, we set out to learn what has already been discovered. In this section, we describe the resulting study and its conclusions.

**Methodology**

We studied all the TPD netcourses in mathematics and science we could locate as of June, 1995, as well as numerous netcourses about educational technology. We studied two TPD netcourse projects and a number of university professors who offer one or more of their TPD courses on-line. In addition to reviewing all printed and on-line material on these netcourses, we interviewed, using telephone interview forms, four groups: project administrators, the faculty, selected participants, and, wherever feasible, dropouts of these netcourses. The telephone interviews were conducted in the summer of 1995.

**Netcourse Technology**

It is important to understand the technology used in different netcourse implementations because the capacity of the software and network strongly influences the quality of the interaction and the ability to build functioning virtual communities.

**E-Mail**

The simplest, and therefore, longest-running, approach to netcourses is to use electronic mail, or e-mail. The advantage of e-mail is that it requires the lowest-denominator technology and is therefore more nearly universal. Currently, international participation in a netcourse usually requires using only e-mail. Its disadvantage is that it supports only plain, unformatted text, and the message size is limited.

**Listservers**

A listserver resides on a network server and contains all the names of people currently in various groups. When a user mails a message to the listserver, it then
“explodes” the addresses and sends copies to each member of the group, requiring
the author to supply one address to reach everyone.

Listservers help build e-mail-based electronic communities by making it simpler to
contact an entire group or sub-groups of a community. Users can decide for
themselves whether they want to join any particular group. This makes it feasible
to have several lists defining specialized interests within a single netcourse
community.

The problem of using a listserver to create a netcourse community is that it
continues to have all the disadvantages of e-mail; text-only documents and
problematic enclosures. In addition, the e-mail arrives in the order it is sent so that
the group conversations can be disjointed and out of sequence.

Conferences

Electronic bulletin boards and conferences get around the problem of illogical mail
delivery by placing the messages in a central place where participants can read them.
Conferencing software offers additional functions that make it more flexible than
simple bulletin boards, but the two approaches are sufficiently similar to be
considered together; we will use the “conference” term to refer to both. Conferences
require a higher level of network connectivity that e-mail. A real-time connection
is needed between the user and the network-based server conferencing software in
order to search the lists and make the selections.

“Threads” are an important concept used in conferences, referring to a sequence
consisting of an initial message and its responses, and, possibly, sub-threads. Good
conferencing software can show the resulting hierarchy of messages in an indented
index or graphically. This addresses the problem of illogical mail delivery, by
making it easy to see and read a set of inter-related messages.

The Web

The Web (WWW, W3, or simply, the Web), supports formatted documents and
hypermedia, created an attractive, readable, and highly linked environment. Web
functionality is improving rapidly, but in the 1994-5 academic year covered in this
study, few potential participants have had access to the Web and the software that
accessed it was relatively primitive. As a result, the Web was not used in any of the
netcourses studied. We can expect that Web software will improve rapidly, making
the technology of choice for future netcourses.

A Sampling of Netcourses

The two TPD netcourse projects and three of the many individual netcourses
included our study are briefly described below. We have selected the individual
courses to illustrate the range of size and format we found.
The National Teachers Enhancement Network

The National Teachers Enhancement Network (NTEN, 1995) at Montana State University at Bozeman is funded by the National Science Foundation. Since fall 1993, NTEN has offered high school teachers an impressive group of graduate-credit science and mathematics netcourses. The NTEN courses are team-taught by university scientists, engineers, and mathematicians paired with active classroom teachers. The project primarily uses netcourses to reach thin markets, that is, to offer to high school teachers highly specialized courses that might not be available anywhere. A sampling of courses offered are Snow Science; Water Quality, Special and General Relativity; Scientific Visualization, Images of Earth, Food Safety, and Genetics.

Participants connect via Internet or a dial-up 800 number and see a menu that is tailored for their individual course to include appropriate Internet resources, library options, and automated file transfer. The project uses the Confer conferencing system.\(^3\)

Enrollment is limited and averages 25 students per course. Courses are modeled on traditional semester-long courses in the sense that the time expected of participants is approximately 45 hours per credit, or for a two-credit course, approximately six hours per week for fifteen weeks. Course design varies by teaching team.

Taylor and Smith (1995) have described their NTEN course on relativity and argue that, while topics change weekly, students need something to do each day. They have a framework of problem set submissions, answer postings, and discussion group requirements that provides an invariant daily rhythm that is applied to all topics. Points are accumulated for meeting all these deadlines that count toward a final grade. Their design is so well-received that it is being used as a model for other NTEN course designers.\(^4\)

Participants in some courses receive an instructional kit for their course that includes a variety of materials such as texts, syllabus, video tapes, and hands-on lab activities. They also receive a manual and tutorial for learning to use the NTEN Network. Technical support is available during regular business hours.

Unlike the other TPD netcourses we studied, NTEN courses have been carefully reviewed by an outside evaluator: Horizon Research, Inc. (Weiss, 1995).

Mathematics Learning Forums

The Mathematics Leadership Program is a joint project between the Bank Street College of Education and the Center for Children and Technology of the Education Development Center, Inc. The project, launched in the spring of 1994, offers on-line

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\(^3\) NTEN has switched to a Web server and Netscape browsers for the 1995-6 academic year.

\(^4\) For additional information, contact Kim Obbink, Montana State University Extended Studies, 406/994-6550, kobbink@trex.oscs.montana.edu.
seminars with funding from The Annenberg/CPB Math and Science Project. The courses, called Mathematics Learning Forums are offered to elementary and middle school mathematics teachers. Each course is prepared as a unit of curriculum that can be taught by any appropriately trained facilitator.

The Mathematics Learning Forums are designed to bring current mathematics reform efforts into classrooms by introducing teachers to new approaches. Each forum focuses on a particular area of instruction including mathematical content, student learning, teaching strategies and assessment techniques.

The courses share a common format. Videotaped examples of teachers implementing a new approach in a real classroom are reviewed. Teachers are asked to use their classroom as a laboratory for the duration of the course. They try out similar activities and spend time participating in on-line discussions reflecting on their classroom experiences. Thus, the coursework is grounded in their current practice. Facilitators raise questions, guide discussion, and provide reflective commentary. Participants exchange ideas, share concerns, and construct new understandings in the on-line community created by the shared purpose of the course.

The content forums focus on elements of a topic within a content area, rather than providing a broad overview. Examples of content forums are, Fractions: Parts of a Whole (K-4); Close Encounters: Problem Solving Throughout Estimation (5-8); and Teaching Probability (K-4 and 5-8). Forums focusing on teaching, student learning, or assessment emphasize current strategies and approaches to teaching mathematics. These include such forums as, Cooperative Learning: Working in Groups (K-4 and 5-8); Mathematics with Manipulatives (5-8); Assessing Students through Focused Observations (K-4), and Assessing Students through Questioning Techniques (5-8).

Each of the Mathematics Learning Forums is eight weeks long and enrollment is limited to twelve. The forums are offered for one graduate credit, in-service credit, or personal enrichment. Participants are expected to spend approximately two hours a week actively contributing to and shaping on-line conversation. Certain parameters are set by the project administrators: participating teachers must have some classroom responsibilities and must work with students on mathematics regularly for the duration of the forum. The project uses a listserver and e-mail. Access to a VCR is required.

Systemic Change in Math & Science Education

Rick Scott of the University of New Mexico offers a course called Systemic Change in Math & Science Education. Most of this course is taught by e-mail using Salsanet, an electronic bulletin board for math and science teachers. Students must have

For more information about the Mathematics Learning Forums, contact EDC Center for Children and Technology by e-mail, cct@edc.org, or by phone, 212/807-4200.
access to a computer, modem and phone line. There are three four-hour face-to-face meetings to prepare students to use the electronic resources and to know each other personally. Since the course is offered on the local bulletin board, it is publicly accessible, and, indeed, a few outsiders have participated.

The focus of this course is two-fold: to offer participants experience with telecomputing and to explore the concept of systemic change in math and science education, both by becoming familiar with projects in New Mexico and by studying the national standards for mathematics and science learning and teaching. The format is a discussion seminar. Each week a different pair is responsible for moderating a new thread. Typically, moderators upload reading material, ask questions, or pose challenges to start discussions.6

**Internet Resources and Education**

Robert McLean, at the Ontario Institute for Studies in Education at the University of Toronto,7 teaches a netcourse called Internet Resources and Education, in addition to a full load of traditional courses. He especially values the opportunity netcourses offer to those students in rural settings where they have few local opportunities to enhance their teaching skills.8

The netcourse provides experience accessing the Internet and focuses on finding Internet resources for use in education. Students create their own collection of Internet resources and present them in a gopher for public access. Participation in this course has varied between 15 students who all completed the course to 35 students signing on, but only 27 completing.9

**Internet-Based Telecomputing**

Judith Harris (1994) offers a graduate netcourse for teachers called *Internet-Based Telecomputing*. While classes meet primarily on-line, she also requires three face-to-face meetings, held at the beginning, midpoint, and end of the semester. These meetings expedite the process of community formation, team project planning, and learning to use different types of Internet resources in a guided, hands-on format. (p. 181)

While learning to utilize the resources of the Internet throughout the semester, students also work on projects. Participants collaborate to create an on-line resource

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6 For additional information contact Rick Scott, (505) 277-7753, scott@unm.edu. The text of the full course can be accessed by ftp to salsa.unm.edu, sign on, and look in the area called Student Exchange.

7 [http://www.oise.on.ca/](http://www.oise.on.ca/)

8 gopher.oise.on.ca:70/11/resources/IRes4Ed

9 For additional information, contact Prof. McLean at rmclean@oise.on.ca
for educators and individually design an activity that is shared and optionally submitted for publication in a professional journal.

**Common Elements**

The majority of netcourses studied utilize conferencing software or bulletin boards for the instructional part of the course. Some required up to four face-to-face meetings with the whole class so participants can “know” who their on-line colleagues are. Some courses are augmented by a media package of materials up-front that include such resources as videotapes, software, or information on disk, as well as the traditional photocopied set of readings. The courses we reviewed varied widely in the level of structure, but all had weekly changes in topics that helped synchronize student activity.

Attrition of one-third was typical, but those who completed these netcourses seem quite satisfied. The scheduling flexibility was appreciated but it sometimes lead to procrastination that resulted in lack of collaboration. Collaboration between participants was valued and did not seem to be hindered by the lack of face-to-face meetings.

All the netcourses depended heavily on two-way communications between faculty and students. The time these required, even in low-enrollment courses, was a concern for many faculty. The written record created by the netcourses was valued by both faculty and students.

**Future Directions**

Netcourses designed with the faculty at the center of the on-line conversations will not be able to reach large numbers easily. Participants, however, seem to value conversations with their peers, so a better design would facilitate conversations between participants on a topic and be more like a seminar: a netseminar.

The technology utilized in netseminars needs to support this seminar-like atmosphere. The Web, when supported by additional functions, will be able to do this. Some of the additional functions that would be helpful include:

**Increased Expressiveness.** It should be possible for all participants to author and share multimedia messages easily that contain display equations, drawings, photographs, formatted documents, graphs, tables, software, specialized files, and Web pages. Sound and video would be nice, but are not critical as long as they require expensive network resources. The ability to generate and share overlays on any graphics within a Web page would also be very helpful for annotation and group discussions.

**Better Support of Asynchronous Discussion.** Because netseminar discussions are asynchronous, it is important to make prior messages accessible. The collection of these messages is the shared knowledge base for the user group, so it should be easy to use and should be represented in a variety of ways that makes it a convenient reference. Additional development is needed to allow
users to view flexibly a collection of messages, their relationships, and their content using a variety of user-controlled representations.

**Scaffolding.** Software scaffolding refers to optional computer-based assistance that learners can use to help create their own understandings. A variety of scaffolding schemes have been used to help in the creation of the shared knowledge of an electronic discussion group.\(^\text{10}\) Since different educational perspectives will lead groups to scaffolding that is similar in structure but different in detail, one can hope that general scaffolding software will be developed that permits the categories to be altered.

**Reminders.** Procrastination is a major problem for netcourses because participants need to be able to fit their interactions into odd, small time slots around a busy schedule. One solution to this problem could be server software that automatically generates user e-mail under various conditions that can be set by both the netcourse designer and the recipient.

**Netcourse Management.** There are a number of netcourse management functions that could be simplified by good server software. For example, registration, section assignments, the creation of server resources, and grade records could all be handled by appropriate server functions.

We can expect that many of these Web improvements will soon be developed by either netcourse developers or others on the network who have similar needs. With this software and good design, netcourses and netseminars can be expected to have a major impact on education.

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\(^{10}\) The CSILE projects (Scardamalia and Beriter, 1994) has emphasized the educational value of scaffolding.
REFERENCES


