Report on ECDS: An Interactive Course on the Internet

Paul J. E. Dekker
dekker@illc.uva.nl

David I. Beaver
dib@illc.uva.nl

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From 3^{rd} May until 12^{th} July 1996, an academic course was given for an international (and intercontinental) group, via the internet. The course was given by Paul Dekker and David Beaver, both employed at the University of Amsterdam. Taking part in the course were twenty people from Japan, Uruguay, the United States, and a number of European Countries. A group of fifty interested observers, spread across the worlds five main continents, also followed the course.

The course subject was Dynamic Semantics, a branch of formal linguistics which grew up in the 1980s, and which impinges upon mathematics, computer science, cognitive science and the philosophy of language. The Netherlands, and the ILLC research institute at the University of Amsterdam in particular, has a leading position in this interdisciplinary research area.

The most distinctive feature of the course is that it was taught entirely via the Internet, in terms not only of distribution of teaching materials, but also of the teaching itself (via weekly "virtual classrooms"). During the preparation of the enterprise, the organizers could find no indication of there having ever been any comparable academic course, that is, any wholly electronically taught course which was both truly international, and truly interactive. For this reason it seemed important to record our experiences, and make them available to a wider audience.

In this document we report on the course, on the methods which were developed and used, and on our experiences with organizing and teaching a course over the Internet. In the first section, we summarize what the course achieved and give our main conclusions. The second section briefly describes those involved in the course, and the third section details the course itself. In the fourth and final section we describe our observations and conclusions in more detail.

1 General

The ECDS course, *Electronic Course in Dynamic Semantics*, took place from 3^{rd} May to 12^{th} July on the Internet. The course ran for 10 weeks, and was preceded by a preparation period in which the students and lecturers could become acquainted with each other, and in which electronic connections could be established and tested. The first week of the course was entirely devoted to practice with the computer setup, the next eight to the teaching itself, and the final week to evaluation of the course by the participants.

The contents of the course were divided into three parts. The first block, which was more general and introductory than the remainder, ran from weeks 2 – 4, whilst two more specialized blocks followed in weeks 5 – 7 and 8 – 9, respectively.

1.1 Aims

The course's purpose was threefold:

1. Firstly, the course was clearly experimental, designed to shed light on the possibility of providing normal academic tuition via the Internet, and to reveal any associated difficulties.
2. The course served moreover to train students on the use of Internet-based electronic communication for study and research purposes, and to provide them with an opportunity for international cooperation via the Web.
3. Finally, the course was obviously intended to familiarize students with subjects relevant to Dynamic Semantics, and to give them a good grip of current research in this area.

1.2 Central Conclusions

We may begin with saying that, to our opinion, the goals of the project were satisfactorily attained. This is discussed more fully in section 4.1. Other conclusions are, in outline, as follows:

1. Despite the current Internet-hype, little is known about the methods appropriate to providing effective and efficient tuition through the Internet. Our experience shows that, if nothing else, electronic teaching requires a major investment of time.
2. The use of new communication methods such as *email* and *chat* is a practical alternative to the standard spoken and text-based methodology, provided the users are already sufficiently conversant with the new media. A pre-course practice period, in which the methods and tools to be used are tested out, is an absolute necessity.
3. Despite our initial anxieties, international interactive communication did not produce insuperable technical or practical problems.
4. A not to be neglected complicating factor in providing interactive tuition across national boundaries, is the variation in local time between participants.
5. Testing student's progress is not, as such, an insuperable problem for distance teaching. Supervision of the testing process remains problematic.
6. Electronic imitation of traditional forms of contact-teaching is possible, and perhaps desirable, but it should be made clear that, as far as current state of the art electronic communication goes:
    - Tuition periods involve a stronger accent on presentation and discussion of existing literature or previously transmitted materials than is necessary or normal in a standard class.

- Unlike in a standard classroom, during realtime interaction in the *virtual classroom* parallel discussion threads are the norm.

These two last points have simultaneously positive and negative sides. Obviously both require some adaption for those used to a conventional classroom scenario.

2 Parties Involved

2.1 Organizers

The ECDS course was given under the auspices of the Amsterdam based Institute for Logic, Language and Computation (ILLC), and the *Landelijk Onderzoekschool Logica* (OzsL, the Dutch National Research School for Logic), within the framework of the *Stimuleringsprogramma voor internationalisering van het Wetenschappelijk Onderwijs* (STIR, a program devoted to development of the international character of scientific teaching).

Involved in the course were the teachers Paul Dekker and David Beaver, and additionally STIR coordinator Erik-Jan van der Linden and ILLC observer Martin Stokhof. On the technical front, specialist advice on Internet use was provided by Jules van Weerden of the *Onderzoeksinstituut Taal en Spraak* (OTS, the Research Institute for Language and Speech) of the University of Utrecht. The system support group of the WINS faculty of the University of Amsterdam provided technical support. On hand technical assistance was provided by course student Dimitris Dimitriadis. The evaluation held at the end of the course was analyzed by Ingrid van Loon.

2.2 Students

Following the (belated) announcement of 24 April 1995, by the beginning of the course a total of twenty students had enrolled, one in Japan, six in the United States, one in Uruguay, one in England, and a further 11 in continental Europe: Germany (5), the Netherlands (3), Poland (1) and Spain (1). The participants came from diverse fields (logic, linguistics, mathematics, computational linguistics, cognitive science and philosophy) and were at widely varying stages (undergraduates, graduates, postdocs and university lecturers).

Five of the twenty participants dropped out during the course (one from Japan, two from the United States, two from Europe).[1] Five of the students (all in Europe) took the course for credit, and all of these students passed successfully. The credits amounted to 7 University of Amsterdam study points, which equals 10 ECTS credits: points within the so-called "European Credits Transfer System".

2.3 Auditors and Observers

The course was followed at a distance by a group of 25 so-called *auditors* from diverse European countries, and also from Australia, Hong Kong, Canada and

1. The reasons given were, in one case, a misunderstanding of the level of the course, and, in two cases, time pressure. Two participants dropped out without giving any reasons.

the United States. The *auditors* were primarily interested in the subject matter of the course, but declared themselves, primarily through time constraints, not able to take part in the course actively. There was additionally a group of 25 so-called *observers*, who were primarily interested in the phenomenon of academic teaching across the Internet. Apart from a range of European countries, this group also included members from Japan, Argentinia, Brazil and the United States. It was intended to inform the observers regularly of how the course was progressing and what activities were taking place. However, as a result of the greater than expected amount of work involved in teaching the course, the teachers were unable to maintain as tight a contact with observers as they had planned.

3 Organization of the ECDS Course

In this section we will discuss, in turn, the general structure of the course, the chosen methods of electronic teaching, the virtual classroom environment, how a typical course week was divided, and the evaluation of the students. Finally, we will give an overview of our use of the Internet in the course.

3.1 Structure of the course

The course ran for ten weeks, starting with a "zero-th" week in which the students and lecturers could become acquainted with each other. The first week served to test out the connections, and to experiment with the use of email as a realtime communication method in class. During this week the students were divided into transcontinental groups, and were given the task of producing combined reports introducing the members of their group to other groups.

The next eight weeks were devoted primarily to giving the course itself. In the tenth week outstanding points were dealt with, and the students were briefly given the opportunity to evaluate the course as a whole. After the course a questionnaire was circulated amongst the students in which they were asked to describe in more detail their experiences as concerning (i) course content, and (ii) the (electronic) form in which the content was taught. The results of this questionnaire are set out in the final section of this report.

The content of the course was divided into three parts. In the first block (weeks 2 – 4) a general introduction was given to a range of *dynamic semantic* frameworks, and their application in the formal semantic analysis of simple *pronominal anaphora*. The second block (weeks 5 – 7) concerned *epistemic modalities in update semantics* and *presupposition*. The last block was devoted to the treatment of *direct reference* in *epistemic semantics*, and *E-type pronoun* theories.

3.2 Teaching Methods

At he beginning of the course a decision was made essentially to imitate standard forms of teaching. Concretely, this meant:

1. that students were asked to study some relevant literature each week;

2. that they received weekly sets of notes — the week's "lectures" in textual form;
3. that they took part in a live discussion of the week's material with the lecturers in the 'virtual classroom';
4. and that they were given assignments to do group-wise once per block.

Communication consisted primarily of exchange of email and documents via *http*. During the course it became clear that the topics which came under discussion during a live session could not always be adequately dealt with during that same session. For this reason the lecturers adopted the policy of producing after each class a so-called "ECDS Issues" document, essentially a digest of the discussion threads combined, if possible, with 'definitive' answers to open questions (see also the following section).

The literature to be studied was specified on the course's homepage each week, and, where practical, was also made available at the same web site. The nature of the chosen communication medium meant that the "lectures" themselves were also provided in textual form, as the so-called "Course Notes" series, which were provided on the Monday or Tuesday of each week, also on the homepage.

This takes us to an important difference with standard forms of teaching. In a real meeting, where spoken language is the normal communication medium, it is possible to give a lecture first, and to top this up with work periods and discussion sessions with the students. Because in our course the lectures were pre-circulated and read, the class session had the form of an additional literature study. It seems plausible that this contributed to the complaint that the study demands were too great, and to the observation that less new material was presented during the virtual classes than is usual in a standard classroom/lecture situation.[2]

3.3 The virtual classroom

The electronically mediated class meetings took place at fixed time-slots during which the students and lecturers were logged in on their own computers, and could discuss the week's topics using an email list `ecds-list@illc.uva.nl`. Each message sent to this list was automatically sent on to all participants. Specific subjects for discussion were at the beginning of each class to be provided by students selected as "First Responders" (see below), and thereafter, of course, by the lecturers and other students. Generally, the lecturer in charge for the given week decided which subjects were up for discussion, as well as putting up questions to be answered by the students (or the other lecturer), and commenting on other participants' questions and observations.

Communication via the email list was not instantaneous. After sending of messages there would typically be a delay of up to five minutes. Partly as a result of this, the class discussion did not attain the strictly linear character that is normal in a conventional classroom. Reactions from different senders

2. Although less information was conveyed to the students during the classroom, these slots were the time when we got the best idea of how much students had understood. So maybe the important info flow was in the other direction.

could be sent simultaneously, and yet be received in varying sequence orders by different participants. Because several subjects could thus be under discussion simultaneously or in varying orders for different participants, parallel discussion threads became the norm in class. Students (and lecturers) could as a result of this choose at will to which discussion thread to contribute, and which to leave until later.[3] This phenomenon, which is unique to the communication medium used, and which in itself also suggest interesting possibilities, was none the less felt by some participants to be confusing.

The possibility of running parallel threads resulted in some topics which had come under discussion not being satisfactorily dealt with during the class. This is what led to the lecturers writing an instalment of ECDS-Issues each week. In this supplement to the course notes, important points which had been discussed or mentioned in the previous class had to be carefully set in comprehensible form and discussed. But whilst it was clear that this exercise greatly benefited the course, it must also be noted that the writing effort significantly increased the lecturers' workload. Similarly, the students' workload was increased by the extra reading.

The classes were held from 15:00 to 17:00 (Central European Time), which meant that a student in Japan took the class from 22:00 to 24:00 local time, and a student in Stanford from 06:00 to 08:00. Although we received no complaints about this, it seems to us not unlikely that such stark variations in local time had an effect on students' alertness and availability.

3.4 Structure of a course week

A typical course week was built up as follows. On Monday or, at the latest, Tuesday, the homepage of the course was updated. On this page there was a short description of the subject matter of the current study-block, and of the new study-week, an overview of the literature to be studied, a direct link to the week's Course Notes and, in most cases, to the primary literature itself.

The students had three days to study the material and work through it as necessary. The material was then discussed in the virtual classroom on Friday 'afternoon'. Following up on points arising in the class, the lecturers could write the ECDS-Issues in the weekend and on Monday, in time to post on the updated homepage. One way and another, this meant that the on-duty lecturer had his 'free weekend' in the middle of the week (Wednesday or Thursday).

Additionally, the lecturers provided 'electronic office hours' twice a week, once late in the afternoon (thus suitable for US students), and once in the early morning (thus suitable for the Japanese contingent). If students had questions, they were guaranteed an immediate answer during the office hours. (Of course, the students could mail the lecturers at any time!) The idea was that if the lecturers' answers were insufficient, the students would be able to come indicate this immediately, and receive further clarification. It must be added that in fact the students made no use of the office hours facility at all.

3. Of course, the fact that all discussion is in written form adds flexibility, and mitigates postponement of reactions to selected classroom contributions.

3.5 Student evaluation and First Responders

In order to obtain study credits the students were evaluated on three things: assignments completed with other team members, contribution to classroom discussion, and, relatedly, performance as 'first responder'.

Assignments were circulated via the homepage at the end of each of the above mentioned blocks. The aim was that the students completed these assignments working together in the transcontinental groups we had set up at the beginning of the course. This arrangement was not completely successful: in each group there were at most two students who were working for study credits, and who thus ended up taking on more than their fair share of work.

Students were also judged on classroom contributions. Active participation (and thus: virtual presence[4]) in the virtual classroom was a precondition for obtaining credits. Also important was their performance as a first responder. Each week two or three students were selected to perform in this way. This meant that they not only had to read the study material, but also were expected to prepare a number of discussion topics. More specifically, the first responders were asked to suggest questions which arose in the selected literature or course notes, but which appeared not to be answered there. That a first responder came prepared with good questions served not only to signal to the lecturers that the responder was getting to grips with the literature, but also provided an ideal method to 'get the ball rolling' in the virtual classroom.[5]

3.6 Overview of Internet use

As indicated, all communication in the course took place via the Internet.[6] This consisted firstly of email between the participants. The lecturers used a separate course account, thus separating course and personal post.[7]

The address list used for in class communication[8] had as members the lecturers, the students, and the co-organizers. Mail sent to such a list is automatically forwarded to all list members. Special group lists were set up for communication between members of a group during preparation of assignments. The lecturers were not members of these lists. Additionally, students in Tübingen and Uruguay took part in the course as self-created groups (respectively `APLJA` and `Minerva`).

In addition to email, intensive use was made of the hypertext and file transfer protocols http and ftp. Course intructions, overviews of topics, users-tips, office hour times, the Course Notes series, the ECDS Issues series, and the assignments, all stood on the course's homepage.[9] The majority of the

4. One of the nicest aspects of an electronic course is that each participant, wherever he or she should travel, in principle has no need to miss a class.
5. The idea of selecting first responders was adopted from Edwin F. Taylor and Richard C. Smith, who reported on their experiences in "Teaching Physics On Line", 1995, *The American Journal of Physics 63*, pp. 1090–1096.
6. With one exception, an occasion on which material unavailable in ASCII, dvi or postscript form was faxed to two isolated participants. Notice that the lecturers were in physical contact with each other, as were a couple of groups of students who jointly followed the course.
7. URL `mailto:ecds@illc.uva.nl`
8. URL `mailto:ecds-list@illc.uva.nl`
9. URL `http://info.wins.uva.nl/~pdekker/ECDS`

study material was also either on the homepage, or available from it via a link to an ftp location.[10] Our student in Heidelberg, Martin Jansche, provided for German participants a mirror of the ECDS location on a local address[11], after serious disturbance with the electronic connection between the Netherlands and Germany early on in the course.

Finally, use was made of a chat-site[12] reachable via telnet. This was used for direct communication, for instance when there appeared to be problems with email, for giving direct and immediate help to participants, and once in an experimental attempt at a truly live discussion. Lack of experience with the chat medium, by both teachers and students, prevented this live discussion from being very successful.

The language of instruction was English. Beyond this, use was made of extra ASCII symbols (for logical formulae in email discussions), from the hypertext mark-up language html (for the web pages), latex source code, and postscript and device independent file formats (ps and dvi). Precondition for taking part in the course was given as access to the Internet (email, ftp, and a web browser), and the ability to print out or view postscript and dvi files.

4 Evaluation of the Course

In this section we state our findings more fully, relating them to the student questionnaire on which they are largely based.

4.1 Aims

Concerning the aims cited earlier, our detailed conclusions were as follows:

1. Firstly, giving academic tuition on a global basis is possible. With only such standard communication methods as email, ftp and http, a course was given which the participants declared to have been successful. And this despite the limitations inherent in the range of communication methods used, and despite the fact that the organization of the course itself could, with hindsight, have been improved. In addition to use of email, ftp and http, other communication methods (chat, video-conferencing) deserve to be evaluated more thoroughly in the future.
2. The course was further intended to train students in the use of the Internet for study and research purposes, to train them in electronic communication techniques more generally, and to stimulate international cooperative effort via the Web. The training aspect was not in practice of great relevance in our experimental situation, since the students signed on for the course were already active on the Internet. For a few students, however, the course did lead to a better appreciation of the use of dvi files, ftp, etc.[13]

10. URL `ftp://illc-sun.illc.uva.nl`

11. URL `http://pc03.idf.uni-heidelberg.de/~martin/ECDS/`

12. URL `telnet://paris.servint.com 6000`

13. Nine of the fifteen student questionnaires were completed and returned. The following table indicates to what extent the students felt that there was an improvement as concerns

Progress as regards cooperation with other students we deem to have been relatively successful. Our original intention, to get the students working with each other at a distance in the pre-created groups, was not itself a great success, since there were two few active participants per group. But in and out of official class times students tended to keep in contact with each other, and to have contentful course-related discussions. Furthermore, a number of the students themselves planned to set up an international reading group. The students made it clear that they felt they had gained through discussions with other students of sometimes quite different backgrounds.

3. As regards the content of the course, the original aims also seem to have been satisfied. It is certainly the case that those who were studying for credit produced worthy contributions to the assignments, and we would expect to see a number of the other students contributing in our field of study in the future as graduate students or postdocs. It was clear from the student survey that the students themselves were also very positive concerning the content of the course and what they had learnt from it.

One of the most attractive aspects of an international course is of course the opportunity it offers to students and researchers in geographic areas where the needed literature and training in such a specialized field is not available. Our Polish and Uruguayan participants provide excellent examples. Even given that they might not have been interested primarily in Dynamic Semantics as such, the mere possibility of becoming acquainted with some of the most recent developments in the wider field of formal semantics and pragmatics was reason enough for them to participate.

4.2 The Virtual Classroom

The virtual classroom sessions were unanimously agreed to have been a success. Initially we had fears that a situation might develop in which nobody would contribute to the discussion, and in which the meetings would consist only of a one-sided set of messages from the lecturers. This fear was most emphatically proven to be unfounded. although it is true that the discussions took a while to warm up each week, in fact there was typically more need to cut off discussions than to invigorate them.[14]

their ability to use standard Internet tools and protocols. A score of 5 indicates that they felt they were highly experienced with a given tool/protocol, and of 0 that they felt they had no experience:

	Before	Afterwards
e-mail:	4.89	4.89
ftp:	4	4.44
http:	4.22	4.78
printing .dvi-files:	2.89	4.11
viewing .dvi-files:	3.11	4.22
printing .ps-files:	2.89	4.44
viewing .ps-files:	2.67	3.67
general:	3.52	4.37

14. Perhaps we should add that the observed pattern of participation may not be representative of what can be expected in further courses. Our group may have been particularly enthusiastic as a result of the experimental character of the course.

Comparing with a conventional classroom, we note the following typical features of an electronic classroom:

- communication is not instantaneous
- participants can contribute in parallel
- the formulation of contributions takes significant time (typing, reading over, and, perhaps, rethinking)
- these factors can lead to separate answers to the same question crossing each other
- all contributions remain available for further comment during (and after) the class

As already indicated above, a number of subjects could come under discussion simultaneously. Students could contribute actively to one discussion thread, and only follow the progress of another discussion thread passively (or perhaps save their contributions until a later point). This form of simultaneous multiple discussion was found to be confusing for the participants.

Another consequence of the measured, written communication form was that the participants gave extra thought to the formulation of their contributions. We see this as having lead to the students feeling more deeply involved in the course, and to them making more profound contributions to it. This effect, of there perhaps being a deeper than usual reflection on study material in the virtual classroom situation, is also noted by Taylor and Smith. The observation is further backed up by the survey.

The lecturers gradually became aware that there were a number of participants who were regularly very active in the discussion, whilst other students remained somewhat more quietly in the background.[15] In the future, perhaps the lecturer will have to provide more direction, calling on the quieter students to pose questions or give commentary. A useful side-effect of the virtual classroom setup is that the lecturer can have a discussion with, or simply encourage, one student, without the other students being aware of this.[16] It should be noted that this sort of "off-line" communication took place a number of times during the virtual gatherings of the ECDS class.

4.3 Other Findings

On preparation for the course

A first notable fact about electronic courses on the Internet became clear during the preparation of the course: there is a serious lack of directly usable public domain information about how such an Internet course should be set up and run. In order to get any hold on how the course should be organized, several days were spent searching the Internet for sources of information, but little usable information could be found. There were more than enough courses of various sorts to be found, but little in the way of orientational documents, user guides for teachers, or analyses of previous courses. By making the version of

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15. But is this any different to a normal classroom? Yes and no. No, in the sense that in every class some students are quieter than others. But yes, in that this becomes particularly significant for an internet course where the lecturer cannot rely on physical observation in aiding judgment as to whether quiet students are following adequately.
16. Likewise students with each other.

this document in English translation freely available on the Internet, we hope we will be making some small contribution to the filling of this lacuna.

A global problem

The setting of suitable times for the course formed, as mentioned, a significant organizational problem. Given that there were participants from Japan, Europe, and South and North America, there were, compared with continental Europe (CET) differences of +7 hours (Japan), -5 hours (Uruguay), and -6 to -9 hours (US). The possibility of splitting the class up into separate Euro-asiatic and Euro-american sections was considered, but not adopted: the enormous amount of extra work could not be justified. Our only strict requirement was that, if possible, the class should not be held overnight for any of the participants. The class therefore had to be given at a time when it was night in the broadest possible temporal zone where there were no participants. Ideally, this would have been a gap of at least ten hours.[17]

On the basis of those who signed up for the course, there were three significant time zone groups without participants, of which none had the necessary 10 hour breadth: the Atlantic (temporal breadth of 4 hours[18]), continental Asia (temporal breadth of 7 hours[19]), and the Pacific (temporal breadth of 8 hours[20]).The last zone was chose, and thus the timing of the virtual class was set at 15:00–17:00 CET, or, equivalently, 06:00-08:00 on the US west coast, and 22:00-24:00 in Japan.[21]

Required study hours

The students generally characterized the course as being very demanding. In part, this reflects the diversity of students' backgrounds, and the fact that the subject matter concerned a newly developed research area. It is also possible that some of the students did not realize that the lecturers at the same time as running an experiment, intended to give a fully fledged academic course, with a full seven credit worth. (A number of participants also recognized that they in fact had not had the time available that we had stated as necessary at the outset.)

In particular, it was the number of required study hours that was found problematic. One factor that may have played a role is the fact that as indicated above, in an electronic course a lot of information that would normally be transmitted verbally is instead communicated in written form (in ECDS via

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17. Eight hours night rest, plus the two hours that the course lasted. When the class began, it should for no participant have been earlier than 08:00 local time, and when it ended two hours later, it should for no participant have been later than 24:00 local time.

18. Between -5:00 CET in Uruguay and -1:00 CET in England.

19. Between Europe and Japan, respectively 0:00 CET and +7:00 CET.

20. Between Japan (+7:00 CET) and the American west coast (-9:00 CET); the difference of minus 16 hours of course amounts for our purposes to the same as the given 8 hour difference, taking into account subtraction of one 24 hour period.

21. A further point to consider was that the local time in Europe had to fall within office hours, given that our impression was that participants there would have less access to the Internet outside office hours than in most other regions. (Smaller number of modems at home, and more strictly regulated entry to university buildings outside office hours.)

the Course Notes and the ECDS issues). In future courses, this will have to be properly taken into account.

Participating as a group

Many participants noted that it seemed to be advantageous for groups of people working together at one physical location to follow the course. If one follows the course with others, messages which are sent round can be discussed and allowed to sink in, and one of the group can read incoming post whilst another drafts a comment or reply. A number explicitly mentioned having missed the possibility of speaking to someone face to face.

In fact there were three 'local groups' participating in the course: a pair of students in Hamburg, a group of five in Tübingen, and one of seven people (six of whom were listening in rather than fully participating) in Montevideo. The experience of the two lecturers themselves was that working as a pair had been an absolute must. It is impossible for one and the same person both to follow all the discussion, react (i.e. in writing) adequately as the only available authority on a given subject, and maintain the orderly progress of the discussion.

Communication problems

The greatest problem that we foresaw in the beginning was a large scale technical disturbance. As early as the second virtual class, there was a serious disturbance, with the consequence that the German and Spanish participants were suddenly completely unreachable, and that other participants received messages with delays of between five and forty minutes. Communication was as a result thrown into confusion, at least to the extent that one can still speak of there having been any communication at all.

Further research and experience taught us that technical disturbances on the Internet are rarely so serious, and certainly do not have to have quite such disastrous consequences. By regularly checking on the log automatically maintained by the system program responsible for email on our local host, we were able to rapidly locate potential sources of disturbance; where needed we were able to reduce the seriousness of disturbances by reconfiguring the ECDS mailing list.[22] The most important moral of this point does not concern any single one of the specific principles that must be followed in order to keep class communication as free of disturbance as possible: it is simply the general point that organizers must take care to be well prepared on the technical/practical front. For a successful electronic course, it is essential that there is technical assistance available, or that the lecturers are able to manage appropriate technical self-help (and preferably both).

22. This led a number of times to a participant having to be temporarily "sent out of class", because his or her address was giving problems. In such a case the relevant participant noticed almost nothing, since they were already receiving little or no post. An advantage of the virtual class is that the 'victim' in such a case is able to read through later the entire proceedings of the class!

Examination and control

One problem that did not come up in our course, but that is foreseeable if such courses are to become regular occurrences, concerns examination. Verifying that a student has taken an exam honestly and without help would be difficult over the Internet, and other forms of examination must be used. A complicating factor is naturally that, as noted, there are advantages to students at the same location participating in an electronic course together as a group: the question of which students have done what cannot easily be answered by a physically distant observer.

Here it must be stressed that these considerations did not play a role in the ECDS course: on the one hand the participants were by and large little interested in study credits, so that examination was in turn not of great relevance, and on the other hand the participants were quite clearly so enthusiastic that there could have been no thought of fraudulent practice.

Course-material, and copyrights

A final point that is awkward in the short-term, but with the passage of time will be resolved, is the insufficient availability of textbooks in electronic form: the material for the course had to be developed largely from scratch. As mentioned, one of the attractive aspects of an electronic course is that it knows no boarders, so that tuition can be provided to students in isolated locations. However, if the tuition requires use of texts available only in print, then that must be announced well in advance so that, if necessary, some students can order books from overseas.

A final point that we will only touch on is the question of (the protection of) the intellectual property rights over course material that is made available over the Internet. Clearly, this is not a problem unique to electronic *teaching*.

Relevant References

In the preparation of the course we are grateful that we could make use of the already mentioned article by Edwin F. Taylor and Richard C. Smith, 1995, "Teaching Physics On Line", *The American Journal of Physics, 63*, pp. 1090–1096, also available as:

- `http://www.montana.edu/wwwxs/netscape/edwin.html`

Another report worth mentioning is produced by the Distance Learning Resource Network (DLRN) "What is Distance Education", on URL:

- `http://www.fwl.org/edtech/distance.html`

The following site addresses are similarly of interest:

- International Centre for Distance Learning
  `http://cszx.open.ac.uk/zx/`
- Global Network Academy
  `http://www.gnacademy.org:8001/HyperNews/get/talk/index.html`
- World Lecture Hall
  `http://www.utexas.edu/world/lecture/`
- Mark Dalton's list of virtual courses on the web
  `http://lenti.med.umn.edu/mwd/courses.html`

- Office of information Technologies (OIT) of the University of Massachusetts at Amherst
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A Follow-up of "Teaching Physics On Line"

In the above cited Taylor and Smith article, thirteen conclusions are reached, with a number of which we will not concern ourselves here. Two conclusions seemed not to be borne out by our experience, whilst four other conclusions were clearly confirmed. Our conclusions in this regard are drawn primarily from the survey which we circulated amongst the students.[23] To summarize, we can say that the students largely confirmed our own conclusions, which is scarcely surprising given that our conclusions resulted partly from earlier communication with the students. The points below are numbered following the order of Taylor and Smith's conclusions.

Point 1: Uninhibiting effects of electronic communication

It was not clear to us that the electronic medium clearly removed barriers to open communication in the class, as Taylor and Smith indicate in their first conclusion, and as we suggested ourselves in the original ECDS course description. There was in fact a notable difference between one group of active and freely pontificating students, and another relatively quiet group. In this connection, in the questionnaire we asked the students for their views on the following two statements:

1. Students have less hesitation before saying anything in class.
2. Students are more hesitant to say anything in class.

No consensus emerged on this point: respectively, 4 and 3 agreed, 3 and 4 disagreed, and 2 and 2 had no view.[24] As far as we could see the students we had may have been just as forthcoming/withdrawn as the same students would have been in a conventional classroom situation.

Taylor and Smith noted alongside their first conclusion that the medium of computer conferencing "is largely race-neutral, location-neutral, status-neutral, age-neutral, income-neutral, disability-neutral, and would be gender-neutral except for the clue of first names." When asked, the students affirmed this, although they expressed doubts about its impact, or even its desirability.

Point 3: Access to the on-line world

Taylor and Smith concluded that "for many students, the computer conference course acts as a catalyst to open the door to computer usage and the on-line world", and we asked the student to give their views on this. The results were inconclusive: two agreed, two disagreed, and five had "No idea". None the less,

23. We should make it clear that we were not in fact aiming to test Taylor and Smith's paper empirically. through the ECDS course we reached our own conclusions, and these motivated many of the survey questions, with Taylor and Smith's conclusions also playing a role.
24. In comparison with the survey results, the replies of one more student, who responded verbally, have been added.

the technical awareness of the students with respect to computer use on the web did, by their own admission, improve.

Point 5: Effects of the written form of contributions

The lecturers noted that their own email contributions in class, however informal and personal they were intended to be, were inevitably formulated with more thoroughness than initially felt necessary. The lecturers certainly had the impression that the same was true of the students. Therefore we asked the students, referring to Taylor and Smith's fifth conclusion: "Having to write out what one wishes to say can be an important part of learning in a computer conference course. Did you benefit from having to *write* your contributions?" In reply, six agreed, one disagreed, and one gave "No idea".

Point 8: Cooperation

We noticed in class that the students reacted a great deal to each other, both explaining to each other and asking each other for explanations. This pattern is stimulated by the fact that the ordinary course of business is not hindered if two students discuss something with each other, something that can certainly create disturbance in a normal class. In the electronic situation, the other participants can only profit from being able to 'overhear'. Regarding our question concerning Taylor and Smith's conclusion that "in the computer conference format, students play an important role in explaining concepts to their students", seven agreed, one disagreed, and one replied with "No idea".

Point 9: Absence of visual clues

Not unexpectedly, and furthermore just as was the case with Taylor and Smith, both the lecturers and the students (all nine responses) missed having direct contact, and missed the possibility of effective visual illustration. The discussions required markedly more effort because everything had to be communicated in written form.

Point 11: Recording of contributions

It was undoubtedly advantageous that everything said in class remained accessible afterwards. Everything said could be, and was, reread later, and this made it simpler to return to selected points and clarify appropriately. We posed the following question: "the computer format allows recording of all public interchanges. Did you benefit from the fact that you could re-access and re-read all interchanges?" Eight answered positively, and one negatively.[25]

The fact that everything was set out in writing also led us to a better understanding of what was actually said and intended. If someone, A, reacted to a message of someone else, B, then A had the full text of B's communication to hand the whole time that A was busy putting his or her first impulsive reaction in writing. Participants (students and lecturers) continued to react to each other impulsively, but the availability of the original text in our opinion probably contributes to keeping reactions to the point.

25. "No, because I didn't have time to do that (except during the class)"

Transcontinental cooperation

Taylor and Smith remarked in their paper that none of four attempts to involve Europeans in their course had succeeded, and they gave four possible reasons for this: different time zones, different languages, different style of tuition (in particular not revolving so much around homework assignments), and the fact that Europeans were unable to take their course for credits. We found no evidence supporting the generality of any of these explanations. Although, given its intentionally experimental character, we would not wish to say that the ECDS course should be taken as representative, none the less we can say that the four factors cited did not appear to have had an effect in holding back participants on our course.