Educational Technology & Society 5(4) 2002
ISSN 1436-4522

Implications of Presenting Pre-University Courses Using the Blended e-Learning Approach

Moti Frank
Technion – Israel Institute of Technology, Center for Advancement of Teaching
Technion City, Haifa, Israel 32000
frankm@tx.technion.ac.il

Gila Kurtz
Bar Ilan University, Bar-e-Learn Center
Ramat-Gan, Israel 52900
kurtzg@mail.biu.ac.il

Nurit Levin
Technion, Department of Education in Technology and Science
Technion City, Haifa, Israel 32000
nuritl@tx.technion.ac.il

ABSTRACT

This paper discusses two pre-university courses presented at the Technion – Israel Institute of Technology – to two remote sites by means of blended e-Learning, a combination of face-to-face and distance learning. These were refresher courses in mathematics and physics that were offered to students who had completed their schooling early and who live and/or work in places remote from the Technion. These students had taken, in their high schools, advanced classes in these subjects. The aim of the research presented here was to examine what happens to teachers and students participating in distance learning projects. The research team accompanied the courses from conception and planning, throughout their execution, and up to the final meeting. Implications of Synchronous Distance Learning are discussed and some implementation tips are offered.

Keywords

Synchronous distance learning, Blended e-Learning, Qualitative research, Pedagogical benefits

Introduction

Background

This paper discusses two pre-university courses (mathematics and physics) transmitted from the Technion – Israel Institute of Technology to two remote sites by means of blended e-Learning, a combination of face-to-face and distance learning. Each course comprised 10 sessions of 3 academic study hours per session. Two sessions were held weekly, in the afternoon, so that each course lasted for 5 weeks. A broadcasting studio was established in the Technion's Center for Promotion of Teaching. Equipment from the Technion's video studio was integrated into the distance learning system. In the computer workshops allotted for the project at the two distant sites, programs were adjusted for linking with the broadcasting studio. Broadband communication lines between the Technion and the two sites were also established. This broadband distance-learning system for the project enabled 2-way communication – video, voice and data – between the instructor and the distant classes, in which each student sat in front of his/her PC and participated in the teacher-student interaction.

What is Distance Learning?

According to Mielke (1999), distance education is a method of education in which the learner is physically distanced from both the teacher and the institution providing the instruction. Learning may be undertaken either individually or in groups. In its original form, teachers using distance education corresponded with students via regular mail, telephone or fax machine. Using various forms of electronic media increases time effectiveness, enables flexibility of location, and improves delivery of information. Electronic delivery also employs synchronous communication, in which class members can participate simultaneously, as well as asynchronous communication, in which participants are separated by time and space.

Comparing Synchronous Distance Learning to Asynchronous Delivery Mode

The literature indicates several advantages that may be achieved by using synchronous distance learning (SDL). Thus, for example, Davey (1999) emphasizes that the instructor can give all the students ongoing and timely performance feedback. In the course described here, much use was made of a tool, also permitting immediate feedback for the instructor.

According to Carr-Chellman and Duchastel (2000), the advantages of synchronous interchanges as compared to asynchronous tutorials include a more direct sense of collegial instruction and immediate resolution to questions posed. Branon and Essex (2001) examined practices of distance educators in regard to their use of synchronous and asynchronous text-based communication tools in their online courses. Their study revealed that the reasons for using synchronous communication included: virtual office hours, creating a community, team decision-making, brainstorming, and dealing with technical issues. It appears that the last three reasons are also applicable to synchronous classrooms like ours. Power et al. (1999) indicate that "…synchronous instruction allows students in multiple, rural schools to communicate in real time with each other and with their instructor, using whiteboards, chat, video, and voice communication."

According to other researchers, synchronous distance learning, as well as asynchronous learning, permit: access to students in remote places, transmissions by a single instructor to several remote sites, and to many students (an economic advantage), and use of statistical data stored in the technological system for follow-up of students' progress. Thus, for example, Sandalov et al. (1999) describe a distance-learning program whose aim was to teach physics to students in remote areas. They emphasize that "…the ultimate aim is to provide access to universities and other academic institutions for more people throughout the country."

Lister et al. (1999) found that the synchronous part of their course was of crucial importance. Learning outcomes and student retention rates in their purely asynchronous courses were often disappointing for all age groups. In the synchronous section of their distance course, they attempted to create a 'social construct' – an interactive, face-to-face classroom. The instructor might begin each lesson by asking if there were any questions about homework, reading assignments or group projects. To help answering students' questions, the instructor can activate the system's whiteboard and shared stored graphics, or solve analytic problems interactively by writing texts and equations on the white board, to appear on all the students' screens. He/she can also call up a 'question and answer' tool that allows real time interactive quizzing and polling. Following the setup of a typical studio class, the instructor may then present a brief lecture on new material, sharing PowerPoint slides and multimedia, or using synchronized web-browsing to lead students to web-sites with course-related content. The synchronous sessions also help keep students abreast of course deadlines, build teams and community, allow students to receive immediate feedback, and improve retention rates. The technology used in the course described here resembles that employed by Lister et al., and we also used tools similar to those described in their paper.

SDL – Challenges and Issues

Apart from the fairly complex logistics of organizing synchronous meetings, the literature also presents some issues with regard to SDL. The necessity of attending classes at specific times, and lack of face-to-face interaction with the instructor adversely affects some of the students. This method is not suitable for everyone.

According to Freedman (1998): "The main aspect in the interaction between teacher and students relates to the affinity between them. The students want teachers who are able to give them human warmth and even an intimate attitude, and can help them to solve their personal problems". According to Wolcott (1995) and Hill (1997), the interaction in distance learning is less than that of face-to-face learning. The teacher cannot see the students' reactions to the study material. He or she may miss out on facial expressions or body language, for instance.

In fact, several researchers relate to the difficulties arising from lack of eye-contact between teacher and student, as in distance learning. Willis and Dickinson (1997), for example, wonder whether teachers can be effectual if they are unable to maintain eye-contact with their students, or to observe students' non-verbal behavior. Weaker students, or those who would be shy of participating in an ordinary class session are likely to be even more ill at ease when they realize that they can be heard in real time by many other students, most of whom they have never even met. "Because of the real time nature, there may be greater social pressure for conformity in participation" (Carr-Chellman & Duchastel, 2000). Monson, Wolcott and Seiter (1999) found that "some students experienced a high degree of state-communication apprehension in synchronous distance education."

Other authors discuss advantages that may be achieved when using asynchronous communication (comparing to synchronous communication). Branon and Essex (2001), for example, note that "distance educators have found asynchronous communication useful for: encouraging in-depth, more thoughtful discussion; communicating with temporally diverse students; holding ongoing discussions where archiving is required; and giving all students the opportunity to respond to a topic. Whereas Bhattacharya (1999) states that her students preferred the asynchronous mode because it gave them a better opportunity to concretize their ideas before responding.

In our case, we tried, as far as possible, to overcome those disadvantages of synchronous instruction described in the literature. For instance, attempts were made to deal with lack of face-to-face meetings between instructor and students by means of blended e-learning – a combination of face-to-face meetings and distance study delivered by technological means. The instructor was filmed throughout, and the film was transmitted to the students' computer screens. Also a camera was set up in one of the classrooms so that the instructor could get an overall view of the class.

Combining face-to-face teaching with some form of e-learning is not a new concept. However, most of the papers describing such combinations refer to asynchronous teaching. The course described here is unique in that it combines synchronous teaching and face-to-face teaching with e-learning as the main component.

Video-based Learning

Video-based learning has significant strengths. First, the visual presence of the instructor allows the students to feel more involved in the live session (Hakes et al., 1995). Video technology backs up lectures, demonstrations, and collaboration by means of additional technologies (Burge & Roberts, 1998). Additional advantages are: the capability of transmitting colors and movement; allowing for a greater range of instructional materials (e.g. photographs, graphics, Power Point presentations); interconnectivity between instructor and students; and a balance between audio and visual presentations. All of these encourage more personalized instruction (Reed & Woodruff, 1995; Burge & Roberts, 1998). Video learning also has an advantage over face-to-face lessons in that the students can be 'closer' to images on the screen, especially with camera zooming. The combination of all these advantages and strengths helps to produce an active and participating learner.

Method

As indicated, this paper discusses two pre-university courses (mathematics and physics) transmitted from the Technion to two distant sites. The courses were given sequentially. Forty students participated in the first course, of whom about 50% participated in the second (the rest 50% couldn't take the refresher physics course because they didn't take advanced physics in high-school). Each course comprised 10 sessions of 3 academic study hours per session. Two sessions were held weekly, in the afternoon, so that each course lasted for 5 weeks. Average age of participants was 21.5 years. All the students stated, in a pre-course interview, that they were familiar with 'Windows' and 'MS Office' programs, could surf the internet, use electronic mail and had good typing speeds.

The project was technologically delivered using a Distance Learning system developed by the 'Mentergy' Company (http://www.mentergy.com), which supplies blended learning solutions. The two instructors for the mathematics and physics courses were from the Technion's pre-university center. Neither of them had any previous experience in distance learning. However, they both had much professional practice in teaching mathematics and physics, and were rated as excellent teachers. They participated in a company workshop to familiarize themselves with the system, and for training in distance-learning. The company's team assisted them in setting up the parameters, and provided technical support throughout the project.

A broadcasting studio was established in the Technion's Center for Promotion of Teaching. Equipment from the Technion's video studio was integrated into the distance learning system. In the computer workshops allotted for the project at the two distant sites, programs were adjusted for linking with the broadcasting studio. Broadband communication lines between the Technion and the two sites were also established.

This broadband distance-learning system for the project enabled 2-way communication – video, voice and data – between the instructor and the distant classes, in which each student sat in front of his/her PC and participated in the teacher-student interaction. Each student had a microphone and earphones for voice interaction. The students could watch the instructor, the slides displayed, and what the instructor wrote on the whiteboard in live video on the computer screen. Each student was also able to hear the instructor and the other students at distant sites. They

could respond to questions vocally, textually, or by means of the yes/no questionnaire, using the polling tool installed in the system. Two-way video was installed at one site for the purposes of the project, and one-way video from the instructor to the class at the other.

Thus, most of the meetings took place in the realm of SDL, i.e. there was no time-lag between instructor and students in spite of physical distance. The asynchronous element included recording all lessons and some of the face-to-face meetings. In each course the first meeting between instructor and students was face-to-face. The students were invited to this meeting in order to become acquainted with each other and with the teacher. They were also provided with some details and information about the technologies and procedures of the program.

In our study we used various tools for collecting both quantitative and qualitative data. For the quantitative aspect, two questionnaires were developed, i.e. pre- and post-. The students completed the pre-questionnaire during the first session of the first course, and the post-questionnaire was completed at the last meeting of each course. The students were asked to fill out forms in 'pencil and paper' writing due to low response rate in e-mail surveys (Schafer & Dillman, 1998). The questions in both questionnaires were mainly based on findings in the research literature, and content validated with assistance of specialists in distance teaching. However, some of the questions were developed specifically for this project, since suitable items were not found in the literature.

The purpose of the qualitative part of the study was to learn about ideas (cognitive aspects), emotions (affective aspect), difficulties, and behavior (behavioral aspect) of instructors and students. Tools for collecting data included 'the observer as participant' observations (Adler & Adler, 1994) at the two sites and in the broadcasting studio, semi-structured interviews (Spradley, 1979; Mishler, 1986) with the two instructors and with seven students, and examining data retrieved in the technological systems. The three types of interviews with the instructors, the interviews with the students, and the observations were held at the beginning, during, and at the end of each course. The number of interviews was not decided in advance. The criterion for concluding data collection was saturation, since further interviews offered no significant new findings (Morse, 1994; Denzin and Lincoln, 2000).

The strategies adopted in the qualitative part served to reinforce reliability (consistency, audibility), inner validity (truth, value, credibility), and external validity (applicability, fittingness). This was carried out by tape-recording the interviews, cross-referencing sources, and triangulation. The latter involved omitting any finding not found in at least three interviews, or by at least three different data collection techniques. The findings were presented to the subjects in order to examine to what extent they agreed with the interpretations offered them (respondent validity). The data analysis strategy used was 'content analysis': definition of analysis units, setting categories (outstanding repeated elements), and examination of frequencies.

The study presented in this paper is based, mainly, on qualitative data analysis. The merit of a qualitative study lies in its internal validity, not in its generalization. Therefore, we do not recommend making generalizations on the basis of the case study described here. However, the findings and implementation tips presented in this paper may serve as a basis for a follow-on empirical/quantitative study based on a random sample and inferential data analysis.

Major Findings and Discussion

Questionnaires

As stated, three questionnaires were transmitted to the students during the research – prior to the first course (mathematics) (n=38), after the first course (n=19), and after the second course (physics) (n=13). Disparity in the number of responses was because some students were unable to attend the face-to-face meetings at which the questionnaires were distributed, and because fewer students participated in the second course (physics) than in the first. Analysis of responses revealed findings relating to a) students' motivation and satisfaction before and during the course, b) positive and negative reactions to distance learning as compared to conventional face-to-face learning, and c) problems about delivering assignments.

Students' motivation and satisfaction

Today the accepted approach is to view motivation as the desire of the individual to devote his/her energies to achieving goals, whether cognitively or unconsciously. Motivation to study is defined as the student's willpower

into invests all efforts – particularly mental – in his/her studies. This motivation regulates drive, target and consistency (Erez, 1997).

Analysis of responses to the pre-course questionnaire indicates that 92% of the students entered the program with high to very high motivation, either because of intrinsic factors (Herzberg, 1966) like the desire to study, progress, and develop; seeing the course as a challenge, and wanting to participate in a unique program; or because of external factors such as a strong desire to improve their chances of being accepted at reputable universities like the Technion, and to get good references for their workplace.

According to Expectancy Theory (Vroom, 1964, 1971, 1998), the effort expended in study relates directly to 3 factors: the individual's assessment of his/her ability to perform a task, the valence, i.e. evaluation of the benefits the individual will derive from the results, and the instrumentality related to her/his evaluation of how much input is required to bring about the desired outcome. The pre-questionnaire analyses indicate that, at least in the beginning of the course, all three factors existed for most of the students – 82% of responses believed that they would succeed, that the course was very important, and that success would help them to achieve their aim of being accepted at the Technion.

When it became evident that the students' motivation at the beginning was so high, it became necessary to ensure that this did not decline during the program. According to Goal Setting Theory (Locke & Latham, 1990), as long as the individual faces specific and challenged goals, the greater the improvement in the level of performance, provided that he/she gets feedback and that there is dedication to achieving the goal. For this reason, throughout the course the students were offered clear, specific and high-level study challenges (though the teachers were careful not to set unattainable targets). Both instructors gave the students ongoing feedback about their comprehension and progress, and from their responses in the questionnaires it is apparent that all of them felt obligated towards the program.

The responses to the post-questionnaire after the first course (mathematics) indicate that the average rating for 'general satisfaction' was about 4, in a scale of 1 (dissatisfied) to 5 (very pleased). However, the response to the same item after the physics course was moderate – averaging a little above 3.

Analysis of responses to the open questions revealed that the decline in satisfaction was due to technical faults and environmental conditions such as malfunctioning air-conditioning in one of the classrooms. Indeed, hardware, software, and communication problems were found to be the principal reasons for dissatisfaction with distance learning (see e.g. Hill, 1997; Hubschman, 1999; and Mielke, 1999).

However, satisfaction with any course – not necessarily of distance learning – also depends on the instructor. Hativa (2000) lists the five qualities of good academic instruction: making the lesson organized, making the lesson clear, making the lesson interesting and engaging, creating a positive classroom environment, and active learning during the lesson. The teachers did, in fact, receive high average marks – 3.6 and up – for knowledge of subject, preparation for lessons and presentation, organization of classes, clarity of explanations, interest, attitude to students and their work, and general level of teaching.

It was also evident from the questionnaire responses that the need to use the computer throughout the lesson did not detract from motivation – 90% replied very positively to the item concerning ease of computer application. Questions about layout of the computer screen received high average responses – live video image of the instructor – 3.9; slides – 4.6; whiteboard used by instructor – 4.5.

Positive and negative aspects of distance learning as compared to traditional methods

As has been stated, in the pre-questionnaire it was found that most of the students accepted that the courses were to be given by a new method both as a challenge and to encourage motivation. However, analysis of the post-questionnaire made evident some reservations. For example, half of the students indicated that they were quite disturbed by lack of face-to-face meetings with the instructor. One third of responses ranged between inadequate/very inadequate for the item relating to ease of contacting the teacher or asking questions via the technological system. These findings concur with those of Wolcott (1995), Hill (1997), Willis & Dickinson (1997) and Freedman (1998).

However, when the students were asked to compare this course with their previous face-to-face studies, the vast majority of responses were positive, defining distance learning as an enjoyable experience. In this section,

responders were asked to note whether they agree (yes/no) that, by comparison with face-to-face learning the course was: enjoyable, exciting, fun, fatiguing, overloaded, etc. This agrees with LaMaster and Morley (1999) – "Overall, students find electronic interaction a meaningful, enjoyable experience.

In addition, two-tailed t-tests were used to assess the differences between pre and post questionnaires of the first course. Overall, the results did not reveal any significant difference on technology-related items except one. The expected (pre-) technology-mediated interaction with the instructor was relatively moderate (M=3.00, SD=1.04) but the actual (post-) technology-mediated interaction with the instructor was higher (M=3.95, SD=0.91). It is a statistically significant difference ($t=-3.37$, $p<.01$). This finding implies that the students were pleasantly surprised at the smoothness of the technology-mediated interaction between them and the instructor.

Assignments

The traditional face-to-face course is usually based on lectures, exercises and home assignments for reinforcement and deeper comprehension. Analysis of responses to open questions in the questionnaires indicates a disappointment with the fact that the program outlined in this paper does not give enough exercises and revision to be done at home. Many technological systems for distance learning do offer relatively simple ways of setting homework, delivering it, and sometimes even for automatic checking of answers (in multiple choice questions). Obviously, homework set by means of this system requires preparation by the teacher. Hence the assignments tool was not used in this project, which was ultimately revealed as being detrimental to the learning. This is one of the conclusions applied to later courses, as described in what follows.

Findings from Observation and Interviews

Analysis of the raw data collected from interviews and observation revealed several frequently repeated items. These were used as categories according to which the collected data were classified. The items came under two headings – those related to the students and learning; and those related to the instructors and teaching. The first item, from the students' point of view, considers the advantages of distance learning over traditional teaching methods. The second considers the interaction between students and instructors, and among the students themselves during the lessons, while a third item relates to the structure of the distance class and study conditions. The teachers' responses in the interviews were essentially concerned with the differences between distance and face-to-face teaching. The first item, from their point of view, concerns preparation and actual presentation of a 'distant' lesson. The second concerns the limitations imposed on student-teacher interaction by distance teaching, and the third item relates to the abilities required for distance teaching.

Students' assessment of the advantages of distance learning over traditional teaching methods

Most of the interviewees remarked that studying at the work place instead of traveling long distances to the Technion was much easier for them. All of them approved of the distance teaching of both the instructors. Feedback can be received immediately by using this tool, and this was perceived as an advantage by everyone. They also stated that they needed to be alert in order to respond, in real time, to the teacher's questions. In general, most of those interviewed enjoyed the experience of learning in a new learning environment.

Interaction – student/teacher and student/student, according to the students

All the students who were interviewed agreed that the need to communicate with the distant lecturer by means of a technological system was detrimental to both the quality and the quantity of student-teacher interaction.

Although the system allows students to transmit, in real time, a query or observation in writing, some of those interviewed complained that the teachers either did not respond at all, or too late. Those who raised this issue thought that it occurs also in traditional methods. Thus, it seems that although the system allows giving immediate responses, the teachers found it just as difficult as in traditional methods. Other students said that it was sometimes difficult to get explanations from the teacher about some slides because they were unable to indicate at a particular point on the slide displayed by the teacher. Others complained that permission to speak was quite rare, as compared with face-to-face instruction. This agrees with findings from other researches. Wolcott (1995) and Hill (1997) found that the interaction in distance learning is less than that in face-to-face learning.

There were complaints about anonymity, and the lack of personal contact. From the students' responses by polling, it appeared that the teachers' approach was general rather than personal. For many students it is important that the teacher knows who they are, and relates to them as individuals. This finding also agrees with those of similar researches.

According to Freedman (1998): "The main aspect in the interaction between teacher and students relates to the affinity between the teacher and his or her students. The students want teachers who are able to give them human warmth and even an intimate attitude, and can help them in solving their personal problems."

Structure of the Remote Class and Study Conditions

As expected, in light of the pre-questionnaire responses it became clear that all participating students quickly learned the system and could control the various functions offered. This finding matches those of researches that tested how adult learners adapt to a technological environment. However, it does not apply to young students (primary and middle school), where many pupils still have difficulty in mastering the equipment or the relevant software (Frank et al., 2002).

As in many standard courses, here too the instructors were faced with the dilemma of whether to distribute copies of slides specific to a lesson beforehand. When this was *not* done for the first course, there were students who complained that they were busy copying the slides for a large part of the lesson. Hence, in the second course (physics), slides were distributed, and this time there were some interviewees who insisted that the slides were so detailed that participating in the actual lesson did not add much. This point will be discussed later in the 'recommendations'.

Many of those interviewed referred to the physical conditions of study. Technical glitches in the equipment (hardware and software), communication problems, and air-conditioning problems interference at certain stages with the process of the course, sometimes causing great confusion among the students. Thus, when teaching is based on technology, constant maintenance of the equipment is mandatory.

Teachers' Preparation for Synchronous Teaching

Synchronous distance learning by means of advanced technology requires careful preparation by the teacher, both pedagogically and technically. Both the instructors of the courses described in this paper attended a workshop given by the company that provided the equipment, to familiarize them with the system and with distance learning. Teams from the company helped to set up the study program and provided technical assistance throughout the project.

At the end of the program, both teachers emphasized the importance of prior training for teaching in an advanced technology environment such as the current project. In their opinion, careful and detailed preparation is imperative for each lesson, and for adapting it for distance learning. This includes planning the teaching material and, in particular, the slides to be used, all of which takes up much time. One of the teachers estimates that at least five hours preparation were required for every hour of lecturing. However, it should be noted that this preparation is a one-time occurrence, and repetitions of the course should require no extra preparation.

Both teachers also felt, however, that too careful pre-course preparation gives rise to lack of spontaneity during the actual lesson: less opportunity to exploit and respond to situations in the class that require modifying the planned order of instruction; exercises for home assignments planned in advance that are sometimes not applicable to what has been taught, or answer the questions asked in the lesson; restricted humorous response to situations arising in the course of the lesson, and which could create a special atmosphere and make the lessons more 'piquant'. We believe that more experience of teaching by this method can help to overcome these difficulties.

The teachers also remarked that the output in distance learning is relatively lower than in conventional learning, and that in the e-learning environment there are drawbacks that make it difficult, for instance, to write complicated mathematical formulae, to draw graphs, to transmit complicated messages, or to present long exercises that require several stages for solution.

In their researches, Mortera-Gultierrez and Fernando (2000) found that if instructors are to be successful distance educators, they must be capable of using at least the following types of interaction: instructor-learner; instructor-content; instructor-technology; instructor-facilitator; instructor-peers; instructor-support staff (technicians); and instructor-institution.

The instructors who taught the course described in this paper were trained to use the above mentioned types of interaction, and used the Garrels (1997) model, which describes five critical elements for successful distance teaching – instructor enthusiasm; organization (i.e. preparing teaching materials in advance); strong commitment to student interaction; familiarity with the technology used; and critical support personnel.

Teacher-students interaction as viewed by the instructors

In distance learning, teacher and student are physically remote from each other, so that interaction is quite different from teaching face-to-face. In this project, interaction was mediated via computer, and complications arose in that if students wished to communicate with the instructor they had to get permission by means of pressing the 'indicator' key. Apart from vocal interaction, the students could also write questions or comments, or send e-mail to the teacher. There are both advantages and disadvantages to written interaction. As with the students, the two teachers stated in interviews that, compared to conventional teaching, teacher-student interaction in distance learning is quite uneasy.

Nonetheless, they both agreed positively about the fact that, apart from the spoken and written interaction, they could also use tools for real-time feedback. For instance, the teacher can present a multiple-choice question and quickly receive the answers from all of the students. Another possibility was receiving anonymous responses from students about comprehension of the study material by using the + or – keys of the distance learning system.

The teachers' reservations about interaction were essentially related to the lack of immediate contact with students – body language, facial expressions, eye contact, which the teacher uses during face-to-face sessions to assess comprehension in the class. There was a camera in the distance classroom that provided an over-all picture for the teacher. However, due to low resolution, details could not be made out.

Eye-contact can also allow teachers to use their own body language. The teachers said that they found difficult the fact that they were unable to set an exercise and then move about the classroom among the students to see what was going on. They were unable to use the 'Socratic' approach – a give and take of questions and answers between instructor and students.

Other reservations related to the fact that in distance teaching one cannot use the hands to demonstrate different examples, or any kind of 'theatre' during the lecture, though these very often help to explain and also create a positive atmosphere in the class.

Abilities required of the distance teaching instructor

In the summing-up interviews, both instructors emphasized that the abilities required for distance teaching are: experience in teaching in general and for courses of this type in particular; ability to concentrate and coordinate working with the technological system during the lecture; and familiarity with computerized environment. This also agrees with the findings of Mortera-Gultierrez and Fernando (2000): "if instructors are to be successful distance educators, they must be capable of using at least the following types of interaction: instructor-learner; instructor-content; instructor-technology … "

Suggestions for implementation

Based on the research presented in this paper and on the literature review (see Introduction), we have reached a number of conclusions and suggestions. All implementation tips in this section require careful consideration and study to evaluate their effectiveness, advantages and limitations.

One advantage of the technological system as used here is that it easily allows for achieving three requirements of good teaching (if the teacher makes use of the opportunity) - active learning, organization of the lessons and

the course, and immediate feedback for teacher and students about students' comprehension. Other aspects of good teaching are no way dependant upon the technological system; but they are dependant solely on the teacher - clarity of explanations, sustaining interest, and a supportive learning environment. In our case, there were differences between the two instructors. Examination of these differences indicates that, with more exactitude of preparation (including some trial recorded lessons and analyzing them together with the teachers, and also preparation of all teaching material in advance), a teacher who has initial problems can also learn to exploit the full potential of the technological systems.

In distance learning it is also necessary to set the students homework, and to return it corrected (in some cases by means of the automatic marking system), both as exercises and for interaction with the students concerning their progress.

A teaching assistant should be selected for each DL class, whose 'other' job is to ensure that the classroom is ready (connected, clean, and cool), the students in their places on time, and all handouts (exercises, summaries) distributed before the lesson. The teaching assistant should have consulting hours at the distance site (at least one hour for every teaching hour) for answering questions, and should be responsible for collecting and correcting exercises (and grading, if the course is for academic credit).

As in standard lessons, the dilemma as to whether to distribute copies of the slides beforehand arose here. We suggest distributing 'skeleton' slides containing only part of the information, so that, on the one hand students will not need to copy the entire slide, and on the other, they can assimilate the exhibited data while writing.

About one hour before the commencement of each lesson, the equipment must be tested for function in the classrooms and for complete communication with the broadcasting studio. A reliable technician must be on hand to deal with any technical problems that may occur during the lessons. Division of responsibility among the bodies involved must be demarcated in advance, to prevent (as far as possible) problem situations where it is not absolutely clear as to who is responsible for locating and repairing them.

We would further suggest that the teacher meet face to face with the students at the beginning, middle, and end of the course, the mid-course meeting to be held at the distant sites.

Individual computers and headsets separate the students from each other, as well as from the instructor. A large screen, loudspeakers and classroom microphones would eliminate the need for headsets and computer screens. Simple voting boxes (1,2,3,4) can be used for multiple choice tests and opinion polls during DL sessions. The students should be facing the camera transmitting from classroom to teacher so that the latter is always aware of what the students are doing at any time (talking to each other, looking at the screen, raising their hand to ask a question, etc.). Students must be able to ask question and receive answers *not* just by e-mail, so that everyone can hear the question. Teachers must be able to ask questions, collectively and of individual students, and monitor classroom and inter-classroom discussions. This can only be done by means of a large screen and loudspeakers, with classroom microphones fully wired (as in a concert hall). There is no reason why two, or even three, classrooms should not be connected, with the teacher deciding whether the second classroom is visible to the first. The DL environment must be interactive.

If the students can interact with each other, without headsets, and the teacher can see and hear all the students (who are facing the camera and classroom microphones), then we believe it should be possible to establish a video-conference rapport as effective as that of any other teaching method used by any good teacher.

Concluding Remarks

Distance learning of the kind described in this paper has obvious organizational advantages in that it can reach students in remote areas, and lectures can be delivered by highly qualified instructors and experts to several sites simultaneously. Courses can be given to a relatively large number of students (an economic advantage), and statistical data stored in the technological systems can be applied to follow-up on students' progress.

The disadvantages of the method derive essentially from lack of face-to-face contact and/or body language between the teacher and his/her students, awkwardness of interaction, dependence on an advanced technology in which technical hitches are likely to occur. The teacher needs to invest much effort and constructing the course (though this is a one-time imperative), and he/she may have problems regarding reacting spontaneously to events in the class, as well as difficulties in writing complicated formulae, diagrams or graphs.

There are those who think that, as far as possible, Synchronous Distance Learning should resemble standard classroom teaching, and insist on the advantages of this type of teaching over Asynchronous Distance Learning. Is this what we are really aiming at? About the disadvantages of traditional teaching, in which the students are passive, much has been written. Based on our findings, we feel that, together with its shortcomings, SDL easily allows for achieving pedagogical advantages (if the teacher takes the opportunity) – active learning, lessons and course organization, and immediate feedback between teacher and student about levels of comprehension. Students should be active, the teacher must do advance preparation for organizing the lessons and the course and the technological systems easily allow for getting and giving feedback. The technological system enables, with relatively little difficulty, the use of multimedia – incorporating video, sound, text, animation and simulation.

References

Adler, P. A. & Adler, P. (1994). Observational Techniques. In: Denzin & Lincoln (eds.). *Handbook of Qualitative Research.* Thousand Oaks, CA: Sage.

Bhattacharya, M. (1999). A Study of Asynchronous and Synchronous Discussion on Cognitive Maps in a Distributed Learning Environment. *Proceedings of the WEBNET 99 World Conference on the WWW and Internet.* Honolulu, Hawaii, October 24-30, 1999.

Branon, R. F. & Essex, C. (2001). Synchronous and Asynchronous Communication Tools in Distance Education. *TechTrends.* 45 (1), 36-42.

Burge, E. J., Roberts, J. M. (1998). *Classrooms with a Difference: Facilitating Learning on the Information Highway*. Montreal: McGraw-Hill.

Carr-Chellman, A., Duchastel, P. (2000). The Ideal Online Course. *British Journal of Educational Technology.* 31 (3), 229-241.

Davey, K. B. (1999). Distance Learning Demystified. *Phi Kappa Phi.* 79 (1), 44-46.

Denzin, N. K. & Lincoln, Y. S. (2000). *Handbook of Qualitative Research.* Thousand Oaks, CA: Sage.

Erez, M. (1997). A culture based approach to work motivation. In: Earley, M. & Erez, M., *New Perspectives on International Industrial/Organizational Psychology*. San Francisco: The New Lexington Press, 193-242.

Frank, M., Reich, N. & Humphrys, K. (2002). Respecting the Human Needs of Students in the Development of e-Learning. *Computers & Education* (in press).

Freedman, Y. (1998). *Teachers and Students – Mutual Respect Relationships.* Jerusalem: Henrietta Szold Institute for Social Sciences Research (in Hebrew, abstract in English).

Garrels. M. (1997). *Dynamic relationships: Five critical elements for teaching at a distance.* Faculty Development Papers. Available online at: Indiana Higher Education Telecommunication System. http://www.ihets.org/learntech/distance_ed/fdpapers/1997/garrels.html

Hakes, B. T. et al. (1995). *Compressed Video for Instruction: Operations and Applications.* Washington, DC: The association for Educational Communications and Technology.

Hativa, N. (2000). *Teaching for Effective Learning in Higher Education.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

Herzberg, F. (1966). *Work and Nature of Man.* Cleveland: World Publishing Company.

Hill, J. R. (1997). Distance Learning Environments Via the World Wide Web. In H. K. Badrul (Ed.) *Web-Based Instruction*. Englewood Cliffs NJ: Educational Technology Publications.

Hubschman, B. (1999). How Do Different types of Adult Learners Adapt to Distance Education? *Paper presented at the Annual Meeting of the American Educational Research Association*, Montreal, Canada.

LaMaster, K. J., Morley, L. (1999). Using WebCT Bulletin Board Option To Extend Transitional Classroom Walls. *ERIC Database, accession No. ED440922*.

Lister, B. C., Danchak, M. M., Scalzo, K. A., Jennings, W. C., & Wilson, J. M. (1999). The Rensselaer 80/20 Model for Interactive Distance Learning. *Proceedings of Educause 99.* Long Beach CA, October 26-29, 1999. Available also at
http://www.educause.edu/ir/library/html/edu9907/edu9907.html

Locke, E.A., Latham, P.L. (1990). *A Theory of Goal Setting and Task Performance,* Englewood Cliffs, N.J.: Prentice-Hall.

Mielke, D. (1999). Effective Teaching in Distance Education. *Report No. EDO-SP-1999-5.* Washington, D.C.: Office of Educational Research and Improvement.

Mishler, E. (1986). *Research Interviewing: Context and Narrative.* Boston: Harvard University Press.

Monson, S. J., Wolcott, L. L. and Seiter, J. S. (1999). Communication Apprehension in Synchronous Distance Education. *Paper presented at the annual Meeting of the Western States Communication Association.* Vancouver, BC, February 19-23, 1999.

Morse, J. M. (1994). Designing Funded Qualitative Research. In: N. K. Denzin & Y. S. Lincoln (Eds.) Handbook of Qualitative Research. Thousand Oaks: Sage.

Mortera-Gutierrez, F., Murphy, K. (2000). Instructor Interactions in Distance Education Environments: A Case Study. *Paper presented at the annual Distance Education Conference.* Austin, TX, January, 25-28, 2000.

Power, D., Stevens, K., Boone, W., & Barry, M. (1999). Vista School District Digital Intranet: The Delivery of Advanced Placement Courses to Young Adult Learners in Rural Communities. *ERIC Accession No. ED449933.* Full text available also at
http://www.tellearn.mun.ca/pubs/kssnnews.html.

Reed, J., Woodrull, A. Videoconferencing Using Compressed Video for Distance Learning. *The Distance Educator* (online). Available at:
http://www.kn.pacbell.com/wired/vidconf/Using.html.

Sandalov, A. N., Sukhareva, N. A., Barry, M., Piper, T., & Stevens, K. (1999). The Development of Open Models for Teaching Physics to Schools in Dispersed Locations in Russia and Canada. *ERIC Accession No. ED449935*. Full text available also at
http://www.tellearn.mun.ca/pubs/russia.html.

Schafer, D. R., Dillman, D. A. (1998). Development of a Standard EMail Methodology: Results of an Experiment. *Public Opinion Quarterly.* 62 (3), 378-397.

Spradley, J. P. (1979). *The Ethnographic Interview*. N.Y.: Holt, Rinehart & Winston.

Vroom, V. H. (1964). *Work and Motivation.* N.Y.: John Wiley & Sons.

Vroom, V. H. (1971). *Management and Motivation.* N.Y.: Viking Press.

Vroom, V. H. (1998). *The New Leadership: Managing Participation in Organizations.* Englewood Cliffs, N.J.: Prentice-Hall.

Willis, B., Dickinson J. (1997). Distance Education and the World Wide Web. In: Badrul, H. H. (ed.) *Web Based Instruction (2nd ed.).* Englewood Cliffs. NJ: Educational Technology Publication.

Wolcott, L. (1995). The Distance Teacher as Reflective Practitioner. *Education in Technology.* 34 (3), 49-55.