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A research framework for the study of a campus-wide Web-based academic instruction project

Rafi Nachmias*

School of Education, Tel-Aviv University, Tel-Aviv, 69978, Israel

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Abstract

The use of the Internet as an instructional tool in higher education is rapidly increasing. The author provides a research framework for the study of campus-wide academic instruction using the Web. This framework consists of three levels: (a) the *macro level*, which focuses on the diffusion process of the Internet on the campus instruction from the institutional perspective; (b) the *mezzo level*, which focuses on the emergence of new pedagogies and learning paradigms in courses that integrate the Web into traditional instruction; and (c) the *micro level*, which concerns the actual usage of the Web in the teaching and learning process of specific courses. First, a background and description of the research framework is provided. Second, the author describes how this framework serves as the research agenda for the study of Virtual TAU—a campus-wide implementation project aimed at integrating the Internet into the traditional instruction of Tel-Aviv University (TAU). Finally, a preliminary discussion of the issues and concerns raised by this research effort is provided.

Keywords: Internet and higher education; Research agenda; Course websites; Evaluation

1. Introduction

The use of the Internet as an instructional tool in higher education is rapidly increasing. Many university instructors are intrigued by the unprecedented opportunities to improve academic instruction presented by the advanced information and communication technolo-

* Tel.: +972-3-6406532; fax: +972-3-6407552.
E-mail address: nachmias@post.tau.ac.il (R. Nachmias).

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gies. They are interested in providing effective and convenient access to information, better communication among instructors, students and peers, and improved learning opportunities. In addition, university leaders and administrators are attracted by the economical potential of using of the advanced technologies and their possible role in changing the structure of higher education (Bates, 2000; Mason, 2000). Consequently, many universities have already started the process of integrating Web technologies in their academic instruction, or are considering doing that (AFT, 2001; Beller & Or, 1998; Bonk, 2001; Lewis, Snow, Farris, Levin, & Greene, 1999). In the last decade, implementation of the new technology in higher education has generated a rich variety of teaching configurations (Bonk, Cummings, Hara, Fischler, & Lee, 1999; Collis, 1999; Harasim, Hiltz, Teles, & Turoff, 1995; Jonassen & Kwon, 2001; Mason, 1998; Mioduser & Nachmias, 2002). These configurations range from the incorporation of Web technology into existing face-to-face courses as an additional information-support tool, to the development of complete distance learning courses.

To look at the impact of these developments within the context of higher education implies, in fact, to examine the ways they challenge the 2500-year-old Socratic, face-to-face, lecturing, and discussion modes characterizing most of college and university teaching. However, alongside the enthusiasm and creativity characterizing this process, essential questions regarding the learning quality and effectiveness of online courses emerge (e.g., AFT, 2000; Phipps & Merisotis, 1999).

Some of these questions are examined in formative or summative evaluation efforts accompanying several online projects in colleges and universities (e.g., Bullock & Ory, 1999; Hiltz, 1997). The focus, methods, and instruments of these evaluations vary. Some, for example, compare between students' achievements in online and traditional versions of a course (Moonen, 1997); others look at the quality of the learning interactions or at students' attitudes and satisfaction (Wegner, Holloway, & Garton, 1999). Phipps and Merisotis (1999) found that most studies of online course effectiveness focused mainly on students' achievements and attitudes, and are based on data collected by means of structured exams and self-report questionnaires. In this way, however, only a segment of the course effectiveness is unveiled. First, the teaching/learning *process* is left out of consideration (e.g., what portion of the developed contents was "consumed" by the students, what interaction patterns were favored by communication-based tasks). In addition, self-reported information is by definition subjective and can be affected by many intervening variables (e.g., "social desirability responding," Hancock and Flowers, 2001). The author of this paper believes that this evaluation should include the implementation of a variety of assessment methods, which aim to uncover *processes* taking place in online courses. Some of these methods should be based on data collected directly during teaching and learning activities. The research framework suggested in this paper takes these issues into consideration.

One of the recommendations of the American Federation of Teachers concerning distance education in upper secondary school is that all institutions offering distance education courseware should become laboratories of program evaluation (AFT, 2000). Following this recommendation, a comprehensive research program is currently being implemented to study Virtual TAU—a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's (TAU) academic courses. In the current academic year (2001/2002),

Virtual TAU involves more than 400 lecturers teaching about 1000 courses to more than 10,000 students.

In this paper, the author suggests a research framework for the study of campus-wide academic Web-based instruction. In addition, the author describes how this framework sets the research agenda for the study of Virtual TAU. The paper concludes with a preliminary discussion of the issues and concerns raised by this research effort.

2. A research framework for Web-based academic instruction

The introduction of the Internet into academic instruction raises essential questions regarding the usefulness and the effectiveness of such usage, or issues like the scalability, transferability, and sustainability of implemented solutions. To address these questions and issues, varieties of comprehensive research agendas are needed, reflecting the various characteristics of the different programs implemented in different universities (e.g., Diaz, 2000; Harasim, 1999; Heinecke, Dawson, & Willis, 2001). Thus, virtual universities that provide online instruction from a distance have different concerns than a university that integrates course websites in traditional face-to-face instruction.

The author proposes a research framework for studying Web-based academic instruction that is more suitable to those universities who integrate the Internet as an enhancement to face-to-face instruction than to distant e-learning universities that are using the Web as the sole platform for instruction. Nevertheless, some aspects are general enough to be of relevance to all higher education institutions.

The research framework consists of three levels of research and analysis. First is the *macro level*, which focuses on the assimilation process of the Internet into the campus instruction from the institutional point of view. Second is the *mezzo level*, which focuses on the emergence of new pedagogical paradigms as these are caused or affected by the use of the Internet. Finally is the *micro level*, which concerns the characteristics and consequences of the actual usage of the Web features within the teaching and learning processes in specific courses.

2.1. Macro level: the assimilation and diffusion process

Questions asked at this level relate to the characteristics of the assimilation and diffusion process of the new technology, to the factors affecting it, and to whether this process follows the commonly accepted patterns of innovation assimilation. Rogers (1995), who contributed a widely accepted conceptual framework for the understanding of diffusion of innovation process, views organizations (e.g., universities) as social systems composed of individuals with varying degrees of openness to technological innovation. The rate at which an innovation is adopted within an organization is a function of three things: (1) certain characteristics of the organization's staff, (2) the innovation itself, and (3) the information disseminated about it. An innovation will be more easily adopted if the potential users are convinced that there is some advantage in using it, and if the innovation is compatible with their current needs and values. Rogers divides potential adopters into five categories, based upon socioeconomic status,

communication behaviors, and personality values: innovators (the first to adopt the innovation, about 2.5% of the users), early adopters (the next 13.5%), early majority (the next 34%), late majority (the next 34%), and laggards (the remaining 16% of the potential adopters).

Questions on the institutional level are for example: What are the conditions required for the innovation assimilation process to succeed (e.g., training, motivated teachers)? What infrastructure is needed? What might be the appropriate incentive for faculty members to invest the extra time and effort necessary to create and maintain their course websites? Do the different subpopulations need similar or dissimilar support? Should the university invest in providing knowledge and training to convince potential adopters that the innovation meets their needs?

Research on innovation diffusion distinguishes between the acquisition of an innovation and its deployment. Fichman and Kemerer (1999) point out a number of examples in the USA where a technology was widely deployed but with limited utilization (e.g., computer-aided design (CAD) systems in the 1980s). If the gap between acquisition and deployment is wide, considering acquisition for modeling prospective diffusion, or for policy decision-making, can result in false predictions. From this perspective, a deeper understanding of Internet utilization is needed.

How long does it take a typical instructor to effectively implement the technology in his or her instruction? A stage model suggested by Mandinach and Cline (1994) offers some assistance in gauging the extent to which teachers use the Internet. This model includes four stages of diffusion: survival, mastery, impact, and innovation. At the *survival stage*, teachers struggle to learn the technology, operating mostly by trial and error while maintaining the status quo in their classrooms. As technical competence increases, the *mastery stage* is reached in which new forms of interaction are developed along with better coping strategies, sounder curriculum models, and less reliance on systems experts. At the *impact stage*, the classroom becomes more learner-centered, technology becomes more integrated in learning activities, and use of systems applications becomes more varied. Finally, (for some teachers) the *innovation stage* is reached, when the teacher restructures the curriculum and learning activities, moving beyond mandated procedures and content. This model offers a perspective for evaluating the diffusion of the Internet into the university when changes in classroom practices toward learner-centered processes are a prime objective.

The question about when the innovation diffusion process has been completed is one that deserves special attention. Rogers (1995, p. 399) defines completion of the diffusion process in terms of reutilization: "Reutilization occurs when the innovation has become incorporated into the regular activities of the organization, and the innovation loses its separate identity. At that point, the innovation process in an organization is complete." In pragmatic terms, the process usually ends when the funding for the project is exhausted. However, given that new advanced learning technologies continue to emerge on a regular basis, does this imply that the diffusion process never ends?

Lastly, there are questions regarding allocation of resources and economical issues. Some university leaders predict (or hope) financial profits at the end of the road. However, all indicators suggest that, in most cases, implementing technology into instruction involves increased workload and expenses. Often, financial and sustainability constraints might profoundly affect the characteristics of the whole implementation and diffusion process. A

systematic examination of alternative economical models is therefore needed in order to predict the expenditure (and potential revenue) at every stage in the process (Phipps & Wellman, 2001).

In summary, research at the macro level should shed light on the diffusion process within the campus, its pace, effectiveness, and costs, as well as on the factors affecting its successful or unsuccessful practice. A study of the process, its participants, and its economical implication may provide university leaders and administrators with the reliable and updated information they need to make crucial decisions for advancing the process of integrating the novel learning technologies in their universities' instruction.

2.2. Mezzo level: shifts in instruction and learning

The mezzo level focuses on shifts and paradigmatic changes in pedagogical practices resulting from the implementation of the new technologies. Harasim on the basis of her rich experience with the Virtual-U in Canada, claims that:

> The new paradigm of collaborative networked learning is evident in the new modes of course delivery being offered, in the educational principles that frame the educational offerings, the new attributes that shape both the pedagogies and the environments that support them, and that yield new educational processes and outcomes. (Harasim, 2000, p. 59)

Focusing on these shifts in instruction and learning, the mezzo level deals with general behaviors of instructors and students while teaching and learning with Web-based environments. The main constituents of academic instruction will serve here as a categorization scheme for their presentation: time/space configurations, information and content, communication and interaction among the participants of the learning process, students and teachers, and pedagogical and didactic solutions.

2.2.1. Time/space configuration

This domain refers to how and to what extent the Internet has made academic instruction more flexible in terms of temporal and spatial parameters. Information and communication technologies (ICT) challenge the traditional definitions of rigid space and time slots (e.g., access *anytime from anywhere*, globally distributed knowledge resources, technology-mediated asynchronous teamwork, alternative communication channels connecting both students and teachers). The questions to be asked in this domain are related to the realization of this potential. For example, to what extent can online instruction replace face-to-face instruction? Can flexible Web-based interactions and access to information free students from having to be physically present at the campus?

2.2.2. Information and content

Content is a major ingredient of any academic course. While studying the course, students use various content resources (e.g., lectures, textbooks, papers, websites, lecturer notes, readings). Instructors, planning and developing their course build their own conception of its content configuration in terms of the amount of knowledge, its representation by means of

different media, its organizational and hyperlink structure, and navigational support. Considerable effort and resources are invested in the implementation of these plans in the development of the actual course.

In face-to-face courses, the most commonly used forms of assessment are exams, reports, projects, tests, or quizzes. These tools give the instructor a certain indication of the level of interaction between the students and the contents. In the case of Web-based content, a different situation exists. Data serving this assessment might be directly collected from the computer logs of the course and analyzed with software packages that enable both quantification and visualization of the students surfing throughout the course's content pages (Sason & Nachmias, 1999). Analyzing the log of page views of the different content screens embedded in the course website, the instructor might gain some notion of the scope of the sources approached by the students. For example, the instructor can know how many students downloaded a paper that is going to be discussed in the next forum or face-to-face lesson. Naturally, the fact that students downloaded a paper does not necessarily imply that they read and understood it. However, knowing that only half of the course participants have downloaded the paper, helps the instructor to prepare himself for the lesson.

With these data collection methodologies in mind, interesting questions regarding student's access to online information might be asked. First, these questions are related to the nature of the resources posted by the instructors on the Web such as: What kinds of resources are posted on the Web by instructors and of what volume (e.g., e-papers, links to other sites, enrichment material)? Second, are questions regarding students' habits in consuming these contents, for example: To what extent do students approach the online information? What are the individual differences among students regarding this extent? And what are the factors affecting student's consumption of online information?

2.2.3. Communication and interaction

In this domain, a concern is the students' and instructors' communication behavior, its extent and qualities, and the way it is embedded in learning processes. The technology supplies course developers with novel synchronous and asynchronous communication tools for the design of learning tasks. An interesting issue is the patterns of use of these communication tools by students during a course. To assess the added value of the tools to a course, it is important to examine the collaboration configurations (their growth, fluctuation, consolidation) that result from the students' interventions and interactions while performing the learning tasks. The actual data serving this assessment might be supplied by the technology itself, in the shape of the logs accumulated while using the varied communication tools (e.g., chat, forums).

A typical use of ICT tools in Web-based learning is the asynchronous discussion forum. Such a tool provides students with the opportunity to communicate, share ideas, and collaborate. Much recent research aims to characterize the nature of the discourse and interactions in online forums (e.g., Baudin, 1999; Cummings, Bonk, & Jacobs, 2002; Hara, Bonk, & Angeli, 2000; Oren, Mioduser, & Nachmias, 2002). The technical feature that enables storage and accumulation of all participants' contributions allows both students and instructor to review previous interactions and to reflect on different aspects of the learning

process within the forum. For example, looking at the distribution of students' participation helps the instructor in locating students who have not participated at all or to identify those who show great involvement in the learning. Or, for instance, re-reading the whole set of messages focusing on a particular topic allows students to consider and reflect on the various lines of argumentation and contrasting positions that have evolved in the discussion.

2.2.4. Student and teacher changing roles

Pedagogical innovations may take the shape of novel instructional formats, with increased delegation of responsibility and control over the learning process to the students. They might promote active and independent learning in which students take responsibility for their own learning, set their own learning goals, create their own learning activities, and/or assess their own progress and/or the progress of other students. ICT might engage students in collaborative, project-based learning in which they work with others on complex, real-world problems or projects. ICT also might provide students with individualized instruction, customized to meet the needs of students with different entry levels, interests, or conceptual difficulties (Kozma, 2000). A major research question is whether all this potential is realized in the learning process.

At the learning and cognition processes level, ICT and the Internet may address aspects such as types of processes fostered (e.g., inquiry, design), target skills (e.g., information handling, modeling), or metacognitions (e.g., reflection, meta-level knowledge). Researchers stress the central role of knowledge technologies in general (e.g., writing, print, information delivery means), and ICT in particular, in the development of cognitive process and skills (diSessa, 2000; Mioduser, in press; Olson, 1994). Current examples are the use of learning tools to enable scientific visualization or modeling, thus, supporting alternative perceptions of facts and processes (Edelson, Gordin, & Pea, 1999); the use of hypermedia-authoring learning tools to support the acquisition of "hyper" thinking and representational skills (Erickson & Lehrer, 1998); or ICT tools serving as cognitive prostheses for physically challenged people's learning processes, compensating for impaired functioning due to physical (e.g., vision, hearing, motoric) handicaps (Lahav & Mioduser, 2001). Research questions to be addressed in this domain concern the extent these tools are used in the learning process and their efficiency (e.g., Bonk & Dennen, 1999).

The most frequent research regarding students is the assessment of students' attitudes towards online academic instruction and their overall satisfaction from the online learning processes. Most of these studies have concluded that distance learning courses compare favorably with classroom-based instruction and enjoy high student satisfaction (Phipps & Merisotis, 1999). Other studies have shown that students complain about the workload required by self-study in the Web-based instruction (Nachmias, Mioduser, Oren, & Ram, 2000). However, student attitudes are affected by so many factors that are not related to the effectiveness of the technology that they are unrelated measures. It may well be that the ease of data collection regarding these variables is what gives them the broad attention of the research community.

The changing role of the teacher is also a subject for research. Is the shift from "a sage on the stage" to "a guide on the side" a realistic one? Does this shift meet teacher's teaching

styles and needs? Will learning be more profound in this guided self-learning? How will instructors adapt to this change? Raising these questions and others are important, considering instructors are the most influential group in the process (Bonk et al., 2001).

2.2.5. Pedagogical and didactic solutions

At the pedagogical level, innovations are defined in terms of novel didactic solutions reflecting theoretical shifts (e.g., from a behaviorist to a constructivist perception of the learning process). The properties of ICT raise the need to examine fundamental questions regarding the desired features of pedagogical models using the technology, e.g., in learning environments of the World Wide Web ("Webagogies," Mioduser, Nachmias, Oren, & Lahav, 2000), in hybrid face-to-face/virtual courses (Nachmias et al., 2000), or in online discussion groups (Oren et al., 2002).

Pedagogical issues affect the ways technology might facilitate pedagogy. In turn, this should lead to better and more effective learning and teaching processes. Research questions should identify and classify the evolving Web pedagogies and assess their usage and their effectiveness.

2.3. Micro level: features of the teaching/learning process in specific courses

The micro level concerns the actual features and consequences of a particular teaching/learning process and of explicit behaviors of instructors and students in specific courses. Most of the research at this level consists of small-scale studies conducted by enthusiastic teachers, describing their experience in one particular limited setup (e.g., one course) and in a narrow setting. There is a tendency to question the usability and the value of such small-scale experiments. Guri-Rosenblit (2001, p. 34), for example, claims that: "Such a limited and fragmented research lacks the coherent strength to influence both the actual implementation of the existing technologies and their future development." However, an in-depth case study, even of one course, might be a source of valuable insight about online learning. At the micro level, there is interest about particular successful Web pedagogies implemented in an academic course, in difficulties teachers and students experience in a particular course, and in the particular advantages and shortcomings of ICT integration in that course. One might learn from comparing the processes and outcomes of an online course to those of a similar traditional course. Finally, this type of study allows for the collection of information and ideas regarding the paradigm shift described at the mezzo level. The appropriate meta-analysis methodologies might help exploit this bottom-up information to shed light also on mezzo-level questions.

3. The study of the Virtual TAU project

TAU is one of the largest research-oriented universities in Israel. Located in the center of the country, it serves about 27,000 students annually. These students are enrolled in about 10,000 courses that are taught by about 4000 instructors in almost every academic discipline.

The Virtual TAU project at TAU (http//:virtual.tau.ac.il) was launched in the academic year 1998/1999. The project aimed to initiate and catalyze a process by which more and more faculty members will use the Internet in their instruction in order to enrich learning processes and to make instruction more efficient and flexible. In Virtual TAU, the course teachers, each one in her/his own way, designs the course website using *Highlearn*—a novel Internet course management system. Similar to other Web-supported course systems (e.g., *Blackboard*, *WebCT*, *Lotus Learning Space*), *Highlearn* allows easy creation of an information tree for the course's content and didactic activities, and supplies synchronous and asynchronous communication tools for the students and the instructor. In addition, it provides various tools that assist the instructor in the administrating the course (e.g., course scheduler, test builder, address book).

The expansion of the project was very rapid. From a very limited scope in the first 2 years, the number of courses in the project increased to 252 in the year 2000/2001 and, currently, in the school year 2001/2002, more than 400 instructors from all faculties and more than 10,000 students are using course websites in almost 1000 courses. These figures are beyond any expectation.

One of the fundamental principles of the project is that the instructors, most of them TAU faculty, maintain full responsibility for the course website. Their views of the objectives, syllabus, and instructional methods lead the development and the implementation of the course. No predesigned pedagogical solution was imposed, rather, each instructor acts according to his or her own pedagogical approach. Most of the projects' activities are aimed at empowering the instructors, helping them in the realization of their pedagogical vision.

In order to assist the instructors, the university established a central support center. The center provides conceptual, pedagogical, and technical support to the instructors, via workshops, on-line tutorials, one-to-one meetings, and a helpdesk. The support center is also responsible for knowledge dissemination via newsletters, seminars, and conferences.

One major objective of the project is to examine and evaluate the potential embedded in the virtual courses and to examine the conditions needed to realize this potential. Implementing the above research framework is a prominent objective of the project.

3.1. The research agenda of Virtual TAU

During the last 2 years, we have started to implement the research framework described in Section 2 within the Virtual TAU project.[1] In this section, the various studies that are currently conducted will be briefly described. It is beyond the scope of this paper to provide full details of the studies. Moreover, since most of the studies are still in their data collection stage, it is also too early to fully report their results. Rather, the author describes for each

[1] The research team of Virtual TAU project includes the following people: Dr. Rafi Nachmias (principal investigator), Judith Ram (director of the support center), Dr. David Mioduser and Dr. Avigail Oren (School of Education faculty), Anat Shemla and Tal Sofer (PhD students), Limor Segev (research coordinator and MA student), Gila Dushinsky, Galia Agam, Michal Tikochinsky, Oshra Sheri-Steinberg, Anat Cohen, Dafna Nagel, Inbal Gazit, and Gideon Zieler (MA students).

study its objectives, the major research questions, the study duration and the methods of data collection. Table 1 summarizes this comprehensive research effort.

At the macro level, two studies are currently being carried out.

Study 1: Diffusion of the Virtual TAU into the academic instruction in TAU. *Study objectives:* To describe the diffusion process of Virtual TAU into the academic instruction at TAU, its scope, and pace. *Major research questions:* Does the diffusion of the Internet at the campus follow the diffusion patterns of innovations described in the research literature (e.g., Rogers, 1995)? What are the characteristics of the TAU staff who have adopted the Internet in their academic instruction? *Study duration:* Five years (1998–2003). *Data collection methods:* Data collection regarding the implementation of the courses is being carried out every semester for the duration of five years. All instructors who are using the Internet for instruction complete a questionnaire regarding their characteristics (e.g., gender, position, ICT experience), their needs, and their perception of the contribution of the innovation to the students' learning. Selected instructors and decision-makers are interviewed.

Study 2: Factors affecting successful implementation of Virtual TAU. *Study objectives:* To identify those factors that affect the campus-wide implementation of Virtual TAU. *Major research questions:* How do instructors perceive the effect of factors, such as their own characteristics, the nature of the innovation, and central support, on how they have been integrating the Internet in their instruction? What are the barriers for the diffusion (e.g., lack

Table 1
Summary of the research of Virtual TAU

Level	Research topic	Data collection duration	Starting year	Data source	Scope
Macro	Diffusion process of Virtual TAU	5 years	1998	Data about course participation	All courses
	Factors affecting implementation	3 years	2000	Instructor interviews and questionnaires	All courses
Mezzo	Innovative Web-based pedagogical practices	3 years	2000	Instructor interviews, websites analysis	All courses
	Survey of Internet pedagogical use	1 year	2002	Websites analysis	300 courses
	Instructors attitudinal and conceptual change	2 years	2000	Instructor interviews, websites analysis	50 courses
	Students attitude and conception	1 year	2001	Students questionnaires	2000 students
	Contents usage by students	1 year	2001	Log files and interviews	117 courses
	Forums participation	1 year	2001	Log files and interviews	30 courses
Micro	Emergent collaboration	2 years	1999	Log files and interviews	6 courses
	Social climate	1 year	2000	Log files and interviews	2 courses
	Course case studies	2 years	2002	Comprehensive case studies	10 courses

of staff development, instructor's reluctance due either to personal teaching style or to negative attitude towards ICT, or limited infrastructure)? *Study duration:* Three years (2000–2003). *Data collection methods:* Data regarding instructors' motivations and perceptions are obtained from the instructors, administrators and decision makers at TAU, by means of interviews and questionnaires. Additional data being collected relate to the support instructors receive (moral, technical, pedagogical, and financial) and the mechanism by which this support is extended.

The following studies are currently being carried out at the mezzo level.

Study 3: Innovative Web-based pedagogical practices. *Study objectives:* To identify and collect exemplary pedagogical practices used by selected instructors participating in virtual TAU (e.g., innovative educational activities, assignments, and didactic solutions). These all are being added to the "Web-pedagogies database" that will be disseminated eventually throughout the campus. *Major research questions:* What exemplary Web-pedagogies ('Webagogies') have been emerging in TAU's academic instruction? What are their characteristics and the conditions required for their successful implementation? *Study duration:* Three years (2000–2003). *Data collection methods:* Web-pedagogies are identified and classed through the analysis of the course websites, as well as via interviews with their developers and instructors.

Study 4: Survey of Internet usage in TAU instruction. *Study objectives:* To reflect the current state of usage of Virtual TAU usage by instructors. *Major research questions:* To what extent do TAU instructors use the Internet as content provider, communication facilitator, creation and presentation medium, platform for the delivery of learning assignments, and administrative support tool? To what extent do they use the Internet for innovative pedagogies that were not applicable before? *Study duration:* One year (2002). *Data collection methods:* A random sample of about 300 course websites will be selected (out of about 1000 courses), to be reviewed and analyzed using a *course website characterization scheme* developed for this purpose.

Study 5: Instructors' attitudes towards, and perception of, online instruction. *Study objectives:* To assess the instructors' attitudes towards and perceptions of online teaching, as well as changes in these after two years of using Virtual TAU in their courses. *Major research questions:* What are TAU instructors' attitudes towards and perceptions of using the Internet as teaching tool? How do these perceptions and attitudes change over time? *Study duration:* Two years (2000–2002). *Data collection methods:* About 50 lecturers are participating in this study. Data is being collected by the mean of interviews in two phases: during the first year of Internet usage and 2 years later.

Study 6: Students' attitudes towards Web-based instruction. *Study objectives:* To assess students' perceptions of the use of the Internet for learning and their attitudes toward it. *Major research questions:* To what extent and for what purposes do students find online learning beneficial, enjoyable, and meeting their needs? *Study duration:* One year (2001). *Data collection methods:* About 2000 students learning with Virtual TAU completed an attitude questionnaire designed for the study.

Study 7: The use of websites' contents. *Study objectives:* To assess the extent to which (a) instructors upload contents on their websites and (b) the extent to which these contents are

consumed by students. Using the data collected in this study, we wish to devise a statistical measure of course "content consumption." *Major research questions:* What is the distribution of Web-based "content consumption" by students? Do students vary in their "content consumption"? (One of our hypotheses is that the variance is quite large, namely that there are students who rarely use the Web, while others use it extensively). What are the factors that affect these behaviors? *Study duration:* One year (2001). *Data collection methods:* About 5000 students in 117 courses were studied while using their course websites. Page views for each content area by each student were recorded and analyzed.

Study 8: Discussion forum participation. *Study objectives:* To assess the extent and the characteristics of forum usage by instructors and students. *Major research questions:* To what extent do instructors use forums in their course websites? What are the individual differences in forum usage among students and for what purposes? *Study duration:* One year (2001). *Data collection methods:* About 200 courses in the academic year 2000/2001 were studied. Only about 15% used forums extensively. Analysis of the messages of all 700 students who studied in these 30 courses, as well as interviews with students and teachers, provides the basis for the study's results and conclusions. *Comments:* Finally, at the micro level, the following studies are being conducted.

Study 9: Emergent collaboration. *Study objectives:* This study focused on the emergent collaboration activities in six graduate courses of Virtual TAU. Emergent collaboration is the process by which group configuration and transactional patterns evolve among participants during the course of learning. *Major research questions:* What are the didactic modes that have been devised for supporting emergent collaboration learning processes? To what extent do students and teachers participate in these processes? *Study duration:* Two years (1998–2000). *Data collection methodologies:* The research population included 3 instructors and 115 graduate students participating in 6 courses. Data were collected by means of log files of students page views within Virtual-TAU, transcripts of forums and collaborative activities, and unstructured observations. *Comments:* The results were published (Nachmias et al., 2000).

Study 10: Social climate. *Study objectives:* To examine whether a social climate evolves in on-line courses of different kinds. *Major research questions:* The study compared a hybrid course (a mixture of online and face to face interactions) and a distant learning course regarding the emergence of social climate. *Study duration:* One year (2000). *Data collection methods:* This study focuses on the content analysis of messages posted by students participating in the courses. *Comments:* Study is described in Oren et al. (2002).

Study 11: Course case studies. *Study objectives:* Ten comprehensive case studies aim to provide information at the micro level regarding the actual implementation of the Internet in the particular courses. Currently, in the academic year 2001/2002, five case studies of Virtual TAU courses are being conducted. Five additional five case studies will be carried out next year. *Major research questions:* Varied according to the case studied. *Study duration:* One semester or 1 year per each case. *Data collection methods:* A variety of data collection instruments (e.g., instructor interview, class observation, students interviews, and analysis of the course website, didactic activities, and learning products) are being used to shed light on the roles and consequences of using the Internet in the courses.

4. Preliminary conclusions

Information and communication technologies are having, and will continue to have, a profound impact on higher education institutions around the globe. Online learning, which was once an unwelcome stepchild within the academic community, is becoming an increasingly more visible part of the higher education family. However, the original research conducted on the various aspects of Web-based academic instruction and learning is still insufficient: it suffers from questionable overall quality and thereby renders many of the findings inconclusive (Phipps & Merisotis, 1999). This situation calls for a rigorous and comprehensive research efforts that will generate conclusive insights regarding how, and in what ways, technology can enhance the teaching/learning process, particularly at a distance. A current report of the American Federation of Teachers recommends the need to conduct more rigorous evaluations of higher education programs using technology and that the results are broadly disseminated (AFT, 2000). The presently proposed research framework is only one step in this direction.

A comprehensive research agenda is unquestionably important. A few elements are still missing to develop a body of influential and meaningful research. Among these are the following.

Asking the fundamental questions: Wagschal (1998) addressed concerns about whether the right questions are being asked when introducing distant education into the academy. According to Wagschal, fundamental questions should be raised, for example, regarding the kinds of knowledge needed by students entering the 21st century. Indeed, the starting point of the creation of a research agenda should include addressing fundamental issues such as: epistemology, learning, cognition and culture, rather on the opportunities, and possibilities offered by ICT to education.

Theory-based research: There is a vital need to develop a more integrated, coherent, and sophisticated theory-based program of research on distance learning. Theory allows researchers to build on the work of others and this increases the probability that the more significant questions regarding distance learning are being asked. Using theory as a guiding framework also allows the research to be replicated and enhances its generalizability, making individual studies more meaningful (Phipps & Merisotis, 2000).

Comprehensive studies: A major gap in the research is the lack of studies dedicated to measuring the effectiveness of entire academic programs rather than individual courses. An effort should be made by the research community to shift from the micro level to the mezzo and the macro levels.

A common language for research: Guri-Rosenblit (2001) describes "The Tower of Babel Syndrome" referring to confusing language and misleading conclusions in the discourse on information and communication technology in higher education. Obviously, until a better common language emerges within the research community, the current huge gap will persist between theory and practice and between research and its implementation.

New research methodologies: One of the arguments presented in this paper is that a variety of assessment methods should be implemented in order to uncover processes taking place in online courses. This should be based on data directly collected during teaching

and learning activities. Of particular interest are new methodologies for online data collection should that should emerge (e.g., Gold & Ethier, 1997; Kehoe & Guzdial, 1997; McLaughlin, Goldberg, Ellison, & Lucas, 1999; Musciano, 1996; Peled & Rashty, 1999).

Communication channels: A large number of books have been published recently on the use of ICT in academic instruction (e.g., Bates, 2000; Collis & Moonen, 2001; Stephenson, 2001). An increasing number of academic journals are devoting their pages to these issues (e.g., *The Internet and Higher Education*, *Journal of E-learning*, *Journal of Asynchronous Learning Networks*). The amount of resources available on the Web is enormous—see for example, the comprehensive list of online learning resources provided by Dringus and Scalese (2001). However, the research communities are not interactive enough and the discourse is not sufficient. Therefore, a major priority is to create an international and national information clearing-house to share data about successful and unsuccessful practice, and to launch programs and initiatives aiming at active and useful research communities on ICT and higher education. One way of doing this was presented by two current international studies on the use of ICT in K-12 schools. In these studies, a huge database of innovative pedagogical practices using technologies in schools worldwide is being created (Kozma, 2002; Venezky and Davis, 2002).

The author views quality research as an essential part of the process of change in academic instruction. The proposed framework intends to advance the creation of a common language among the participants of the research community. The author would therefore welcome and appreciate any remarks and suggestions that may contribute to the improvement of this research framework.

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