been playing an increasingly large part in the design of human society and in the way it functions today and will in the future. According to various reports,[1] as of June 2000, there were about 322,000,000 active users of the Internet in the Western world and Asia, and it is expected that a similar number will become active users by the end of 2003. The generation that is growing up surrounded by information and communication technologies and absorbing these technologies both quickly and deeply will play a decisive role in the future design of society (Tapscot, 1998). It is anticipated that by the end of 2000, there will be personal computers in two thirds of the households with children in the United States—double the rate of households without children—with about half of these connected to the Internet (Tapscot). In Israel, as in other parts of the Western world, many children and teenagers are already connected to the Internet and make wide use of it (Nachmias, Mioduser, & Shemla, 1999). The Internet today is a place where people conduct work, make contacts, and engage in commerce, entertainment, and interpersonal communications. It is also becoming increasingly a place for learning.

In the past, a country's level of development was measured by its gross national product (GNP). Now, a new variable is being added to this formula: the rate of Internet use per number of households. When we use this variable, Israel in spite of its small size and lack of natural resources could be considered among the developed countries.

The articles in this issue's International Review demonstrate the use of the Internet for learning in Israel. They show the pervasiveness of its use and its growing power in the educational system, though without ignoring the problems that may arise.

The first paper is by David Mioduser, senior lecturer at the School of Education of Tel-Aviv University, head of the special field of studies on educational technology. Mioduser is also a co-representative of Israel to the International Education Association (IEA), on technology. Mioduser's article classifies the uses of the Internet in education, bringing as an example a study on the nature of its use in one Tel Aviv high school. One of the uses of the Internet that Mioduser presents is for instruction and learning, which is the topic of the second paper, by Tova Mittleman, head of the Secondary Education Division in the Israeli Center for Educational Technology (CET). Mittelman expands on the the use of the Internet for instruction and learning by describing the development of a virtual high school and the challenges it presents.

1 See, for example:
http://euromktg.com.globstats
http://www.edweek.com/sreports
http://nces.ed.gov/fastfacts

Naama Sabar is Associate Head of the School of Education at Tel- Aviv University.

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Internet-in-Education in Israel: Issues and Trends

by David Mioduser

□ In September 1969 the first host-to-host message was sent from the University of California at Los Angeles to the Stanford Research Institute (SRI). With the addition of two more nodes by the end of 1969, at the University of California at Santa Barbara and the University of Utah, the four host computers composed the initial ARPANET network. Since then, the Internet seeds have germinated. In time, more networks developed; personal computers entered the scene; people with varied interests (e.g., scientific, educational, commercial, political) expanded the initially limited population of Internet users; and by the early '90s the World Wide Web (WWW) was born, allowing easy

interaction with large repositories of hyperlinked information and with people around the globe.

Since its inception, the development of computer communication technology has been accompanied by attempts to assimilate it into education, in pursuit of teaching and learning goals (Mioduser & Nachmias, in press). In the first stages, two particular features of the technology were implemented in educational projects: (a) message exchange (e.g., e-mail, bulletin boards) and (b) information search, retrieval or delivery (Chandler & Loosley, 1997). The creation of the first graphic browsers and the WWW in the early '90s was a crucial turning point regarding the widespread implementation of computer mediated communication in education. The thorough combination of multimedia delivery capabilities, intuitive visual interfaces, support for efficient search and retrieval of information, and embedded allowance for synchronic and asynchronic communication, along with the abrupt expansion of cyberspace into a huge hyperlinked repository of information, was perceived as a new powerful resource for teaching and learning purposes (Khan, 1997).

Diverse Israeli educational agents (e.g., universities, schools, and Ministry of Education units) accompanied these developments from the very first stages, and participated actively in the creation of pedagogical and logistical models of implementation of the evolving technologies into educational processes. In this paper I aim to depict the Internet in the educational scene in Israel from three perspectives: (a) the systemic level, regarding policy decisions and actual state of affairs in schools; (b) the pedagogical or curricular level, regarding didactic functions and solutions developed and implemented for the educational use of the Internet; and (c) the student level, regarding their immersion in the Internet culture and their assimilation of Internet-related tools, skills and learning modes.

In Israel as in most countries, these are transition times, both at the technological (what will be the technology in use three or five years from now?) and pedagogical (what novel "Webagogies" will be in use?) levels. Consequently it is not possible yet to present a comprehensive, representative, and stable picture. A better approach will be to elaborate on the trends (and underlying currents) characterizing the continuously evolving field of information and communication technologies (ICT) in education in Israel. This paper is therefore built upon vignettes excerpted from my ongoing studies, each one highlighting substantial aspects at the three reference levels mentioned above.

The Internet in the Israeli Educational System

At the systemic level, I will refer here to the educational implementation of the Internet from two standpoints: (a) national policies, as defined in official documents and plans, and (b) actual situation in schools, as reflected in a recently completed study (Mioduser, Nachmias, & Baruch, 2000).

The introduction of computers into the Israeli educational system began at the high school level as early as the 1970s, focusing mainly on computer science studies. In the late 1970s computers were introduced throughout the entire educational system, mostly in the form of tutorial and drill and practice systems, serving teachers and students in several curriculum subjects. In the 1980s, the entering of computers to the educational system was still not systematic, and mostly local in concept as seen in local policies and projects. In 1990 the Israeli Minister of Education appointed a committee to examine the promotion of science and technology in the Israeli education system, and the development of a national policy for the implementation of computers in Israeli schools. On the basis of the resulting report, a national five-year plan (1994–1998) known as "The National Computerization Program" was established. This plan included goals and guidelines for the implementation process for all age levels, in the pursuit of several main goals:

- To supply the required infrastructure to all Israeli schools;
- To support students' acquisition of ICT-related skills and knowledge;
- To foster the implementation of the technology in different subject areas;
- To intensify preservice and in-service teacher

training in the use of the new technologies; and

- To encourage and support national programs and initiatives.

The Internet in its current technological form and widespread use was not a prospect considered by policymakers at that time, and as a result was not included as an important component of the five-year plan.

This pre-Internet nationwide effort produced contradictory results. On the one hand, the computerization plan helped consolidate the human, pedagogical and technological foundations for what is today a solid reality in most Israeli schools. Massive hardware dissemination was accomplished. A large number of teachers were trained. A considerable number of public and private institutions (e.g., university-based laboratories, the Center of Educational Technology, and private educational software producers), succeeded in generating high quality knowledge and products. However, on the other hand, the process unveiled key problematic issues that prevented the full attainment of the goals. Among the most salient were: (a) most investments were made at the hardware level, reflecting the implicit assumption that if the computers were there, the other components (e.g., teachers, curriculum, and assimilation into the school activity) would accommodate themselves to the new situation; (b) the extent and pace of staff training in the first stages was far from satisfactory; (c) almost no funding was dedicated to research and development (R&D); (d) the pace of change of the technology was faster by far than the pace of its assimilation by the educational system; thus many (once, well-equipped) schools find themselves today with hardware and tools that are not appropriate to multimedia or Internet-based learning activities; and (e) the outside-of-school world (namely the students' exposure and involvement with technology-based activities at home, community centers, and museums) was not taken into account as a legitimate learning space and, consequently, appropriate linkages were not created.

In light of this situation, recent policy initiatives have aimed at coping with these issues. Recent documents generated at both the Ministry of Education and the Parliament's Committee for Education emphasize:

- The need to enhance learner and teacher learning and knowledge-handling skills, and lifelong-learning skills (over hardware)
- The need to ensure reliable accessibility to Internet contents and tools in all schools, by all students and teachers, "anytime anywhere"
- The need to support R&D fostering the creation of both basic research knowledge and quality learning materials and opportunities.

The practical translation of these suggested policies into concrete implementation steps is still in its planning stage.

The above issues, thus far presented at the national policies level, can be illustrated with factual data from a recently completed study, the Second International Technology in Education Study (SITES—Module 1) of the International Educational Evaluation (IEA) (Pelgrum & Anderson, 1999). In this study data were collected in a representative sample of the Israeli educational system, about 600 schools from the elementary (E), junior-high (JH) and high-school (HS) levels. The school principals and the ICT coordinator were asked to supply comprehensive information regarding the implementation of ICT in the schools. In this section I will briefly refer to some of the data regarding the Internet (collected in early 1999).

The principals regarded the acquisition of Internet-related skills and the use of the Internet for communication and information-retrieval purposes as important learning goals. The percentage of principals favoring the goals was: *use of e-mail*, E-46%, JH-58%, HS-71%; *access to external databases*, E-55%, JH-71%, HS-88%; *collaboration with other schools*, E-52%, JH-56%, HS-60%. Even higher were the figures for the principals' overall consideration of Internet relevance for teaching and learning (E-85.8%, JH-87.8%, HS-87.5%).

Actual implementation data show that the percentage of schools with Internet access for learning purposes was E-35%, JH-53%, and HS-72%. The majority of the remaining schools reported that they plan to complete their access to the Internet by 2001. These facts clearly reflect

the existence of a gap between the perception and formulation of Internet-related goals, and the reality in the schools.

Table 1 shows a sample of the issues for which data were collected (a full and comprehensive report of the International study appears in Pelgrum & Anderson, 1999, and on the Israeli subset in Mioduser et al., 2000). In general terms these data reflect a modest actual implementation of Internet-related activities at the student, teacher and school levels. An increase in Internet use occurs with age level. Very low activity was reported regarding collaborative projects or Web site creation and maintenance (two strong pillars comprising the rationale for using the Internet in education). Main issues perceived as obstacles to the achievement of the goals relate to hardware and organizational aspects (e.g., time, and teacher training).

The data reflect, in actual implementation terms, the main emphases and concerns embodied in the policies that guided the ICT in education implementation process in the '90s.

Emerging Didactic Solutions Using Internet

In contrast with the somewhat problematic and contradictory picture unveiled at the systemic level, a growing number of high quality local enterprises and pedagogical solutions characterize the rapid assimilation of the Internet in countless educational settings. A clear policy (and its consequent translation into concrete implementation activities) is still being defined and devised. Meanwhile, a vigorous grass roots movement gives birth to varied and highly creative initiatives. The origin and scope of these initiatives range from a single-classroom-based and motivated-teacher-led activity, via university- or R&D agency-based projects, up to systemic implementation projects generated in the Ministry of Education or school networks. For the description of several of these initiatives I will use a classing framework referring to four main functions for Internet use in teaching and learning processes: (a) content delivery, (b) instructional delivery, (c) communication support, and (d) creation support (Mioduser, Nachmias, Oren, & Lahav, 1999). (See Web References for project URLs.)

Content delivery

The first and most obvious feature of the Web is that it is a huge repository of hyperlinked knowledge. Information and knowledge manipulation functions (e.g., generation, transmission, storage, processing, and retrieval of information) are at the heart of educational transactions. The possibility of contributing to, or accessing, online libraries, databases, e-journals, museums, and other public information containers on the Internet fulfills valuable educational functions.

Table 1 ☐ Internet-related activities and issues—data from principals' and coordinators' reports showing percentage of schools reporting engagement in selected activities.

Issues	*Elementary*	*Junior High School*	*High School*
Student use of e-mail and Internet for learning	16	29	53
Teacher use of e-mail and Internet for teaching	18	32	50
Collaborative projects within or outside school	4	9	11
Access to World Wide Web databases	13	22	50
Development of Websites by students	1	3	14
Schools owning Websites	7	18	35
ICT coordinator holding appropriate Internet training	51	52	63
Obstacle—students' lack of available time for Internet activities	29	45	64
Obstacle—teachers' lack of available time for Internet	35	32	43

Examples of Internet implementations focusing on content-delivery are online digital encyclopedias and libraries, and topical Web sites and portals.

Among a large number of projects in Israel, salient representatives of these kinds of initiatives are the *Snunit* (originated at the Hebrew University in Jerusalem in 1994) and the *Center for Educational Technology (CET)* portals. These sites serve as large portals to a vast number of information and knowledge pages, in varied subject matters and for all grade levels. Today these portals offer students and teachers much more than the provision of information or knowledge. They also incorporate a large variety of didactic models for accessing and using information on the Web through exhibitions, thematic projects, polls, and curricular activities.

Many interesting models for content delivery were developed in Israel in the format of topical Web sites, focusing on specific topic or content areas. Examples of these models are the *Knowmagine* Virtual Museum for Science Technology and Culture (by Tel-Aviv University School of Education), which includes interactive museum exhibits and activities and a hyperlinked knowledge center, and *The Migrating Birds Know No Boundaries* site (the Israeli Ornithological Center), where students can participate in online research of bird migration from Asia, through Israel, to Africa, and their nesting in Israel.

Instructional delivery

A large number of didactic resources is available in the Internet, from plain raw materials that may serve as building blocks for lesson plans, to complete learning units and curricular solutions. Numerous Web sites provide educational activities and courses for all grade levels in a large number of subjects (Hackbarth, 1997; Khan, 1997). The concept of the Web as learning environment is gaining more and more adherents, and is instantiated in varied forms; for example, distance learning courses and even degrees, collaborative learning projects, virtual schools and universities, and virtual environments for complementary and informal education.

The Israeli *Aviv* Virtual High School is a joint initiative of the Ort Israel network of schools and the Snunit Educational Information Systems at the Hebrew University of Jerusalem, serving more than 6,000 students in 23 public schools throughout the country. Its basic assumption is that classroom and virtual environments each offer essential advantages. Thus Aviv is presently developing and implementing courses that combine the two teaching modalities. Most Aviv courses bring Internet-based activities with their own "virtual teacher" into the classroom, complementing the roles and functions of the classroom teacher. At the same time Aviv is experimenting with courses taught almost entirely through the Internet. Other activities rely much more heavily on lessons, examples and exercises that are delivered via the Internet with only a minimum of teacher intervention. Some Aviv programs serve as an Internet component to a semester or year-long course; others are self-contained units on specific topics that can be integrated into the school curriculum.

Additional interesting models based on the integration of the Internet in teaching processes are *The English Global Village* (Amalnet), and the *Hospitalized Children School.* The English Global Village aims to help students improve their English knowledge and competency using the Internet. The activities in the Village are based on guided research, taking the student on a step-by-step journey through the Internet, gathering information at each stop, assimilating new vocabulary along the way, and generating reports. The Hospitalized Children School offers children hospitalized at the Soroka Medical Center access to an enrichment program of studies and distance learning using network facilities and video cameras. The Eshel Hanessi Regional School provides to students hospitalized in the Center access to their regular studies using video conference facilities and Internet-phone.

Communication support

The Web is increasingly becoming a virtual milieu for new forms of interaction, collaborative work, and learning among partners in educational processes (e.g., students, teachers, experts, and parents). Computer-mediated

communication (CMC) provides powerful interaction means (e.g., e-mail, forums, teleconferencing, and IRCs) which have the potential to enhance both the extent and quality of educational transactions (Berge, 1995; Harasim, Hiltz, Teles, & Turoff, 1995). The demand for pedagogical forms that transcend a school's space and time constraints is not new. But now the advent of advanced communication technologies opens the way for the construction of novel instructional configurations (e.g., distributed team-work, hybrid solutions combining face-to-face and virtual-learning, learning communities, and telementoring).

Among the numerous projects actually functioning in the Israeli educational system, I will describe two for illustrative purposes. The first is the *Meteor Center*, used in kindergartens in the town of Or-Akiva. The Meteor Center, a science and technology center used by 5-to-6-year-old children, is designed as a home, allowing children to experience daily usage of home technology and appliances including ICT. In the Internet-based activities, children from different kindergartens (including English-speaking children in the United States) communicate with each other regarding common topics or stories. For this purpose, a special iconic language ("smilies," using all keyboard characters) was developed, and continues evolving as the collaborative learning activity proceeds.

A second widespread model based on communication via the Internet is that of the Learning Communities of Students and Teachers (Oren, Nachmias, Mioduser, & Lahav, 2000). *Matar* (TelAviv University and CET) is an example of such a community for science and technology teachers. The Web site offers teachers a forum for professional dialogue and mutual enrichment, communication channels with experts regarding both pedagogical and disciplinary issues, exchange channels for ideas, pedagogical resources and teaching materials, and access to virtual courses.

Creation support

The Internet is becoming increasingly a creation environment. A considerable number of user-friendly tools for the creation of Web-deliverable materials are currently available. These tools (e.g., Web-page editors, teleoperation environments, image processors) support students' creativity and initiative, allowing them to generate and publish their own Web units without mediators and with minimal technical assistance.

A relevant example is the *OSH* project in the Ohel-Shem High School in Ramat-Gan. The project already comprises more than 30 Web sites created by students and teacher in various content domains. The project is perceived as a school enterprise, continuously growing year after year (for three years now). It affects the learning process not only of the core group of students and teachers actively involved in the development but also, by spreading out in concentric circles, of students and teachers from all age levels and content areas. In addition, the project has affected the school climate and culture both at the individual level (e.g., the students' perception of their learning capabilities, of opportunities for self-expression and contribution to the community), and the school level (e.g., its status in the local community, and attractiveness as an educational environment).

A different model is embodied in the *Digital Portfolio* project in Leo Beck School in Haifa. At the core of the project is the process of collaborative writing of interactive books by heterogeneous-age groups. In the process, the students are exposed to interactive texts and innovative writing styles and techniques (e.g., nonlinear configurations, hyperlinked Web pages), build interactive texts and develop their own writing style, and compose a digital portfolio while assessing their own and their peers' learning.

The above examples were presented only as illustration of the extensive activity carried out by countless agencies at all levels. Although they are not representative of the whole picture, they do fairly reflect the prevalent trends among educators and researchers working toward implementation of Internet technology in education.

Internet Usage by Students

The third level of observation of Internet usage in education in Israel is the student level. Don Tapscott (1998) claimed that for the first time in

history, children are more comfortable, knowledgeable, and literate than their parents about an innovation that is central to society. The use of computers and the Internet not only gives children powerful intellectual tools, but also contributes to shaping their thinking about the most basic concepts of their selves, for example, identity, evolution, relationship, and sexuality (Turkle, 1995). Many questions regarding the purpose, the extent, and the patterns of Internet usage among school students still deserve to be studied, such as:

- How many students belong to the circle of Internet users?
- How much time do they spend on this activity?
- When do they begin to use the Internet and how does such usage develop with age?
- For what purpose do they use the Internet (e.g., information retrieval, communications, creative activities)?
- Do they "surf" the Web alone or in groups?
- Do they use the Internet as a helpful resource in their academic work, and how?
- Can differences in the extent and the habits of Internet usage among boys and girls be pointed out?
- What is the role of the schools in this process?
- Do teachers encourage children to use the Internet?
- How does this usage affect traditional learning processes?

To elaborate on these questions regarding Israeli youngsters' involvement and interaction with novel communication technologies, I will briefly present and discuss data from a study conducted among high-school students (Nachmias, Mioduser, & Shemla, 2000). The study was conducted in one six-year comprehensive public high school in Tel-Aviv (grades 7 to 12), attended by middle and upper socio-economic status students. This school is a typical urban school similar to about 60% of the high schools in Israel (it may not represent the situation in rural, development-towns, or orthodox religious schools). Participants were 384 students, 208 girls and 176 boys. Student distribution among grade levels was: 67 students in Grade 7, 68 students in Grade 8, 63 students in Grade 9, 59 students in Grade 10, 65 students in Grade 11, and 62 students in Grade 12. All students were administered a questionnaire containing 87 open-ended and closed questions. Some of them were interviewed to obtain a more detailed description of their attitudes, motivation and patterns of use of the Internet. The following are selected excerpts from the study's data.

Extent of Internet use. About half of the students (46%) in all grade levels use the Internet to some extent. More boys use the Internet than girls: an average of 56% of the boys, and only 38% of the girls reported Internet use ($\chi^2 = 12.8$; $p < .01$). Surprisingly, the percentage of users all along the different age levels (from 6th to 12th) was not significantly different.

To identify patterns of Internet use by the students I focused on five main parameters: (a) how much time a week they spend using Internet; (b) when, (c) where, and (d) with whom they use the Internet; and (e) how they acquired the required knowledge and skills.

Time dedicated to the Internet. The average time per week students spent using Internet was 5 hr 50 min: less than one hour a day. A closer look at the data, however, showed that about a third of the students work with the Internet an average of more than two hours a day. No significant difference was found in the extent of Internet use per week among grade levels. Significant difference in time usage was found between genders ($p < .05$). Boys spent more time than did girls: an average of 6.38 hr per week versus 4.37 hr per week.

Preferred location for use. Most students preferred to use the Internet at home (82.4%). Other locations mentioned were: friends' homes (33.0%), school (17.0%), and parents' workplace (4.5%). Significantly more boys than girls indicated that they preferred to surf the Internet at home (90% versus 82%, $p < .01$).

With whom do students prefer to surf. Most students (72.0%) surf alone, 47.4% with a friend, and 3.4% with their parents. No significant dif-

ferences were found between genders and among age groups.

How did students learn to use the Internet. More than half of the users learned to use the Internet by themselves, using manuals and books (53%). One quarter (25%) learned from friends, 7% in school, 6% from their parents, 5% from elder brothers, and a few took an Internet course outside school (4%). Significant differences were found between boys and girls ($p < .01$), 64% of the boys and 39% of the girls learned autonomously. No significant differences were found among age groups.

Purpose for Internet usage. The most common and frequent use of the Internet by students was for communication (53%). Gathering information, downloading resources and writing school work were the next most frequent activities, reported by 30–40% of the students. Use of the Internet for creation and for distant learning was considerably lower.

Linkage between Internet usage and school. About 70% of Internet-using students used it to support schoolwork. In addition, 60% used it to enrich what they learn in school, 17% to prepare exams, and only 13% to participate in discussion groups related to school activities. To the question Do teachers encourage them to use the Internet? only 31% of the students responded affirmatively. When students were asked if the Internet is accessible to them from school, only 19% stated that it is often accessible, 60% said that it is seldom accessible, and 21% that it is not accessible at all. Most students viewed the Internet as an important potential tool for education (48%), or at least with some potential for education (48%), and only 4% viewed it with no potential at all for education.

Based on the study's data, a number of conclusions can be drawn. First, about half of the youngsters were already involved in some way in using the Internet in their everyday life. I found that youngsters primarily used the Internet for communicating (e.g., e-mail, chat), and only secondarily for information manipulation. The social interactions allowed by the new technology, specifically synchronic (e.g., chat) rather than asynchronic communication forms (e.g., forums), seemed to meet significant needs of this population.

Previous studies regarding the initial phase of implementation of novel information technologies reported significant gender differences in usage. A similar phenomenon was encountered in this study. Boys used the Internet more than girls, and the differences were consistent for most variables considered in the study; that is, time spent on the Internet, gaming, or downloading resources. A crucial question to be addressed is whether the identification of the Internet as a male occupation is an unavoidable trend or a cultural bias that will be balanced as the technology becomes more integrated in people's lives.

Another surprising finding was that no significant difference in extent and mode of use was found among age levels. It could be expected that because of the complexity of the technology and the skills required for working with it, Internet use would be more frequent among older students. The findings indicate that youngsters today are being exposed to new technologies at a very young age, and that they become involved in learning and using them at a very fast pace.

Finally, the Internet culture among youngsters evolves predominantly outside school time and space. It may be that schools lack either the physical infrastructure (appropriate equipment, facilities) or the philosophical-pedagogical infrastructure (appropriate comprehension of the cultural and social essence of the technological transformations and their value for learning). The fact is that most Internet-using youngsters do not see the school as a relevant agent in the Internet milieu.

Concluding Remarks

The Internet-in-education scene in Israel is as exciting as multifaceted; evolving rather than stable and definite. Using a well-established Internet metaphor, it is still (and continuously) "under construction." As such, Internet usage is characterized by contrasting (and even contradictory) processes, by multiple development

currents (from underground to surface-level or official), by uneven (human, technological, or knowledge) resources distribution, and by a highly creative drive.

It is all but unavoidable that all agents involved in this process (e.g., The Ministry of Education, school staff, universities and R&D centers, and private agencies) must address in the near future a number of key issues, among the most important:

- Forming updated policies for ICT implementation in education, in light of the overwhelming conquest of the technological scene by Internet-related technologies.
- Closing the gap between formal policies and actual implementation in terms of infrastructure, human resources, and pedagogical support.
- Exploring and formalizing the new Webagogies, novel pedagogical solutions for the digital space.
- Exploring and formalizing the prospects for these novel pedagogical models to be transferable, scalable and sustainable beyond the successful and specific locations at which they were generated, toward the whole educational system.
- Reconsidering the very essence of the idea of learning settings and their spatial and temporal nature, in light of the "anywhere and anytime" capabilities allowed by the technology, and the fact that large amounts of learning take place outside school time and school place.

Finally, two additional issues should be addressed regarding the individual and social aspects of the assimilation process of the new technologies in education. (a) At the individual level, equity issues are of salient importance: how to ensure equal access and opportunity to enjoy the benefits of the new technologies to all students. Inequities based on variables such as location or economical resources were taken into account at the policy making and planning levels, and offered diverse solutions (e.g., supply of infrastructure, staff training, and curricular reinforcement). (b) But a more essential issue, as unveiled in many studies including the one sampled in this article, relates to the deepening gender differences in learning and working with the technology. It should be noted here that the picture depicted in the research literature is neither uniform nor conclusive. On the one hand, in many studies focusing on situations in which a whole group or class works with the technology (namely, all the girls and boys in a class participating in technology-based learning situations), no differences were reported between genders regarding achievement or skills acquisition. On the other hand, in most studies focusing on situations in which students had to choose to participate in technology-based learning processes, or had to report on their own attitudes or learning process, differences between genders did appear. In others words, gender differences appear to have deep cultural and social-related roots, affecting both the motivation of girls to approach technology and their perception of their own competency in technology-related tasks. A high priority is for researchers and educators to address these issues and unveil the factors that may contribute to answer gender-technology–related questions.

A final remark at the social level refers to my observation that in the evolution of the Internet culture among youngsters, the center of gravity is not located in the school but in the home. An attempt to analyze this reality should focus on unveiling the deep cultural issues at the root of the potential conflicts between the school and Internet cultures. Among other characteristics, school culture can be characterized as mainly nondemocratic (as an organization), highly structured, pursuing a highly defined set of objectives, fostering social equity. On the other hand, the Internet culture is perceived as overdemocratic, open-ended, nonstructured, and highly individualized, and without any commitment to social equity (Logan, 2000). One can think of two possible outcomes of this conflict between the two different cultures. The first could be that significant changes in a school's set of values and structure will take place while it assimilates key components of the Internet culture. In an alternative scenario the Internet will remain outside the school world, but yet a central activity for youngsters in nonschool settings, challenging school status as main knowledge

provider and communication facilitator. Both scenarios suggest major changes in educational processes, resources, and configurations as the Internet reshapes the ways we learn, work, and communicate. □

David Mioduser is senior lecturer at the School of Education at Tel-Aviv University, Ramat-Aviv, Tel-Aviv, Israel. He may be reached at miodu@post.tau.ac.il.

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