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An Embarrassment of Technology
Why Is Learning Still Difficult?

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Abstract
This article is intended to present differing views on the meanings of learning as they relate to the use of computers in modern education. It reviews the relevant literature, identifies problem areas, and concludes with recommendations on combining technology and learning as school districts move forward in the information age. Because initial encounters with technology are difficult for both students and educators alike, this paper advocates improving the learning environment with regard to technology by bringing technology support systems into play, enhancing adult learning as a means of enabling learners, and placing greater emphasis on social informatics. (Keywords: adult learning, end-user computing, management, social aspects of computing and learning, social informatics, technical culture, technology applications in education and business.)

The modern education system is awash in technology. Millions of dollars are spent each year on computers, computer networks, and a wide range of peripheral technologies designed to turn classrooms into more productive environments. Although this expenditure on technology is not universal, and the gulf between the haves and the have-nots continues to widen, many districts find themselves with a literal overload of technology. And yet, much of this largesse, this abundance, this embarrassment of technology, is wasted due to poor planning and implementation. Why is this happening, and why do educators and

students still find learning difficult despite access to enormously capable technologies once thought to be a panacea to education in the 21st century?

Claims and Counterclaims in Technology Applications

Proponents of information technology (IT) claim that its benefits include achieving democracy; reducing power; ending reductionism; open and instant access to learning, teachers, and students; and the elimination of hierarchy, elitism, and distance. Specifically, communication and information technologies are said to transform education (Gilder, 1990), deliver a universal format (Gilder), transform learning (Perelman, 1992), and transform organizational culture (Barrett, 1992).

According to this body of research, communication and information technologies will enable people to have knowledge without learning and productivity without some investment in learning infrastructure without considering the *human moment* ("an authentic psychological encounter that can only happen when two people share the same physical space," Hallowell, 1999, p. 59) in technology applications. Perelman (1992), in particular, extols the virtues of *hyperlearning technology* that will enable virtually anyone to learn anything, anywhere, anytime, and proposes this new technology as a total replacement for conventional learning and schools. Perelman contends that hyperlearning and connections with different computers eliminate hierarchy.

Like Perelman, MacDonald (as cited in Thompson, 1998) asserts that online courses will eliminate elitism and liberate learners from the yoke of a lecture room stating, "the Internet has the potential to eliminate the elitism. … Internet-based courses break down many of the barriers that previously prevented people from obtaining a university or college education. … With online teaching methods, students feel that they have the professor's personal attention" (p. 5).

Most proponents of technology applications in education equate better learning with the acquisition of more technology. They rarely, however, confront the subsequent questions of resource allocation for learning, its support, and the learning infrastructure needed to learn without distance and hierarchy. Both Perelman (1992) and MacDonald (as cited in Thompson, 1998) recognize that the key to solving learning problems through technology rests on this question of distance and hierarchy. Learning without distance requires modern, well-maintained, networking systems and equipment. In addition to the initial capital outlays, schools must be prepared to shoulder the follow-up costs of training, maintenance, and periodic system upgrades.

Bem (1999) states the benefits of computer-based training as "CBT is an ideal teaching tool Sˇ learner driven, flexible, and highly effective … participants can also learn … at their desks … on the road, at night … available when employees want it. … CBT courses are also engaging, colorful graphics, sound, animation and interaction create a lively environment" (p. 16).

These different claims about the benefits of computer-based training call for more serious examination, specifically from a social informatics approach. *Social informatics* is a multidisciplinary research field that examines the design, uses, and implications of information and communication technologies in ways that take into account their interactions with institutional and cultural contexts (Kling, Rosenbaum, & Hert, 1998). It approaches computing (using and learning computers) as interrelated and interacting systems that involve people, technology, and organizations. It attends to the problems of computer *grinders and minders* (those who perform routine tasks, mostly clerks) as well as those belonging to the experts. Social informatics provides feedback on the successes and failures of technology use in modern education and is able to differentiate between the progress in the human-computer interface (HCI) and how users actually achieve tasks using improved graphical interface (Nahl, 1998). This differentiation helps us reconcile

advances in computer interface by understanding how they are used and function.

Franklin (1990) also informs us of the value of social informatics, noting that "if one doesn't watch the introduction of new technologies and particularly watch the infrastructures that emerge, promises of liberation through technology can become a ticket to enslavement" (p. 100). Franklin also observes that "what needs to be emphasized is that technologies are developed and used within a particular social, economic, and political context. They arise out of a social structure, they are grafted onto it, and they may reinforce it or destroy it, often in ways that are neither foreseen nor foreseeable" (p. 57). According to Illich (1973), "science can clarify the dimensions of man's realm in the universe. Only a political community can dialectically choose the dimensions of the roof under which its members will live" (p. 95). Both Franklin (1990) and Illich, therefore, consider social and political issues as more critical than technology to the increase or decrease of elitism and suggest the need for more focus on people and their organizations.

In education, learners and users are facing the problem of economic and cognitive access to the Internet. Some users are becoming more sophisticated, but the majority are still struggling with basic computing problems. The effectiveness of the Internet as a tool for learning is diminished by visible data overloads that, according to Park (as cited in Byod, 1998), decrease the ability to see the interconnectedness of things. This problem was recognized early on, but the requisite skills for understanding and filtering remain relatively underdeveloped or not well maintained. More than a decade ago, Leiss (1990) pointed out that, "abundance of data flow requires elaborate filtering" (pp. 137–139). Given the nature of these problems and the general lack of quick-fix solutions, it is premature to recommend online learning as a universal and efficient learning method for all learning and teaching.

Advocates of computer-based training assume that cognitive and economic access and the ability to navigate are easy and well developed.

Such assumptions tend to discount or ignore problems inherent in using PCs and overstate the potential of information technology. They give no clue to the human moment (Hallowell, 1999) and to emerging learning and computing problems. Legget and Persichitte (1998) further discuss 50 years of technology implementation obstacles as blood, sweat, and TEARS, where TEARS is an acronym for lack of **t**ime, **e**xpertise, **a**ccess, **r**esource, and **s**upport. Dennis (1998) warns people not to "chase new technologies" (p. 112) without examining their claims—claims that tend to deny the complexity of learning, the necessity of supporting users, and the urgency of creating a conducive learning environment. Whether more access, more online training, more online facilities, more information, more virtual learning, and asking the experts is appropriate to all learners or users is still unclear. There is a serious focus on interactivity, hyperlinking, connectivity, access, speed, storage, and unlimited benefit from technology without focus on human beings, their education, and skills. The problem in such presentation is the serious omission of users, support, and learning. To date, there is no satisfactory answer for the question: Is the interface (interactivity) in the recently developed computing world mutual, reciprocal, and understandable?

Since the dawn of the computer age more than 50 years ago, technology has been expected to magically improve our lives without a great deal of human intervention. Part of the reason that we have been lulled into this false sense of techno-security is that society has glorified technology, ignored the importance of social relations in the use of technology, and, finally, underestimated the difficulty inherent in understanding technology and using it properly.

Reality, we find, is quite different from the common perception of technology as automata working toward some state of universal good. To discern the truth, it is important to ask how many and what kinds of people are capable of using the technology that is available. Today, there are an estimated 70 to 80 million office workers using computers in the United States and another 10 million in Canada. The fact that we do not know how many of these people can actually transfer a document file

between computers or use e-mail or advanced features such as word processing is due to our spending too much time observing MBA students engaged in computing research, for example, instead of observing ordinary clerks.

Nahl (1998) reports that only 5% of the U.S. population is online. When asked, nonusers attribute their nonparticipation to a lack of knowledge and lack of realistic user-training programs. In their study of electronic mail use at the World Bank, Bikson and Law (1993) also found a general lack of knowledge among users and a lack of realistic user-training support programs. What proponents of technology applications in education and business need to realize is that learning and using computing facilities requires a balance between what Zeleny (1989) identifies as "technology support net" (p. 47). (training and support) and software and hardware. The use of technology, therefore, needs to account for the skill levels of those using it as well as the limitations of the technology itself. There is no one best system, and resource allocation for education is limited, but recognizing these realities and considering the human element involved in technology use has economical benefits that must not be overlooked. In fact, it is the very promise of economic benefits that makes social informatics such an important part of information technology.

To consider online learning as effortless and empowering without serious attention to cognitive and economic access and to consider online learning as the paradigm of a healthy learning experience is reduction at its worst, and it is likely to solve problems without personal awareness of the barriers that exist in learning and using technology (Ferrell, 1987). Before claiming that online learning will reduce reductionism, it is important to reflect on how the approach to online learning itself is reducing learning problems to distance, cost, and hierarchy. Online learning can stretch the process of teaching and the boundaries of the classroom and at the same time, eliminate the inequities in gender and class we experience in other forms of media and learning aids.

Feenberg (1991) argues that there is no eminent criterion of progress, excellence, and efficiency and suggests that social institutions must adapt to technological development. Moreover, Feenberg makes the assertion that "the process of adaptation is reciprocal, and technology changes in response to the conditions in which it finds itself as much as it influences them" (p. 130). Based on the Feenberg research, there would seem to be no single optimum way to achieve progress, excellence, and productivity. To understand the paths to these different optimums, one is strongly encouraged to embrace social informatics as a discipline if for no other reason than the difficulty of locating literature with the right blend of technical knowledge and historical perspective outside the milieu of social informatics.

The practices of learning and teaching involves a high degree of structure, complicated routines, and problems that are not easily subjected to the technical and cost-benefit analyses commonly used in discrete entity models of computing (Kling & Scacchi, 1982). Although teachers and trainers are limited by environmental, social, and cultural constraints that exist within the education community and getting superiors to accept new models and ideas can be difficult, change can, in fact, occur as schools are reoriented to achieve new goals.

Training (class)rooms are well-organized cultures with social organization, curricula, and defined expectations. A computer enters this social context with no due consideration for probing and posing questions. Most are inserted into existing classroom structures without changes in classroom organization. Layering the new technology on the old (probing and questioning), the implicit on the explicit, and the self-evident on the problematic creates ambiguity and pressure in learning and teaching (Star, 1995). Learning without time for asking questions discounts the premise that learning is a meaning-making or meaning-finding process. Probing and posing questions is a necessary part of learning and developing meaning from that which is learned. Meaning itself is about context, and it emerges from the process of understanding,

a process that defies technical analysis. Research indicates that the creation of a functional learning environment (classroom), teachers' computer knowledge and experience, and the social organization of the classroom are responsible for improved learning (Mehan, 1989), not the computer alone.

Disagreement and Conflict in Computing Environment

Ongoing disagreement and misunderstanding exists between experts in computing environments. This state of affairs encourages experts to raise a technical question and develop a cultural solution or vice versa. Some theorists present sharp criticism of technology while still focusing on the liberating potential of technology. Such self-contradiction was identified by Feenberg (1991) as "technology has become the great vehicle of reification" and that "science and technology is the great vehicle of liberation" (p. 76). Reification and liberation cannot have the same vehicle. Computers as a mirror of work processes and as "a house of mirrors" (Star, 1995, p. 6-7) are not the same. To confuse the two encourages conflict, myths, and misunderstanding, rather than learning.

Given the level of disagreement, conflict in computer use environments is common. It is therefore naive to expect autonomy, self-expression, and participation when problems are rejected, and when existing learning opportunities or impediments are not well discussed, identified, and recognized. What is upgrade, fast, and recent for the expert is not the same for other users. What is intuitive and visible for the experts is not intuitive or visible to users. People still have problems with computer interfaces, what does "fast and easy" mean to a learner who is not yet clear about his or her problem or who is misunderstood for his or her anxiety?

Considering information technology to be a unique technology that is meaningful without a human being validates what some writers call computer *prophecy,* technological *drama,* and *myth* (see Yeaman, 1993, for details). For example, without some authority and accuracy, using

materials from the Internet is not easy. Expecting sound learning simply from posted online learning or from the Internet without some organized help is similar to thinking elitism is eliminated simply by having computers or Web pages.

Educators, researchers, and managers need to help people learn and use computers before they classify users/learners as computer-phobic or relate the joy or pain in learning computers to gender and mathematics. It is better for researchers to examine the meaning and effects of the words *abort, execute,* and the acronym *CRY* in Visual Basic before they state that girls are more *x* or *y* than boys in learning and using computers.

The immediate manifestation of poor understanding with regard to learning and its context is the development of negative attitudes among computer users. Although technology enthusiasts tend to dismiss these negative attitudes as incidental problems or figments of human weakness, they are the result of a lack of trust or lack of some arrangement or contract between a user and an expert or between a trainer and a trainee.

Apple (1987) indicates the extent to which the focus on the *individual as a stand-alone problem* is becoming *technology as a stand-alone solution.* Kling and Scacchi (1980) identify major problems inherent in approaching technology as a stand-alone solution to all human problems. One cannot reduce problems in information technology to simple incidental or technical problems. Reduction is a distortion because it ignores the interaction and the reality of the problems as well as sound explanations. Doing this creates disagreement, conflict, and myth, shattering hopes, dreams, and the will to learn rather than helping people learn.

Instead of focusing on technology bases, it is better to develop deliberate action to improve learning and to consider what Hallowell (1999) identifies as the human moment missing in information technology.

Imbalance between the human moment and various learning systems and their effects are not well recognized. Seen from this perspective, the above different claims reflect the lack of understanding in technology applications for the human equation and the role of the human moment in online learning. Online learning without some support may shatter dreams for the majority and enhance learning for the few.

Beyond Claims and Counterclaims

Jones and Paolucci (1998) recently reviewed more than 800 journal articles to examine evidence that supports claims that technology can improve students' achievement. They concluded that the body of evidence is not large enough to support the supposition, and they suggest a need for more serious research.

Quick introduction and implementation of computer systems, which is common in schools and business offices, indicates the extent to which approaches to technology introduction neglect the necessary steps and progression in the learning process of different stakeholders. The common approach minimizes the learning process involved during implementation. A study conducted by Zammit (1992) reports that "in the history of computers in schools it has been easier to approve expenditure to purchase equipment than to pay for time to enable teachers to develop their knowledge and expertise" (p. 65). Emihovich (1992) also notes that "computers are purchased with little thought as to how they will be used, and budgets do not include monies for software and in-service training" (p. 505). D'Amico (1990) explains that "computer implementation came too quickly to the district, asked to make a decision to participate in May, installed in July, train staff in August, and begin to use in September" (p. 105). In this situation, it is reasonable to ask if it is possible or rational to expect teachers to integrate computers into the curriculum.

The technical challenge of learning to use computers for the first time is the major hidden problem. Hammond (1990) reported the effects of

exposing teachers and computer users to technology with little prior training. Coping with the hardware and software questions left them drained and frustrated. For teachers, information technology became a labor inducing tool rather than a time-saving device. Here Hammond's research indicates the extent to which computers remain a perplexing burden. The result of focusing on software, hardware, and technical solutions has given us a huge amount of resources and models to use—an embarrassing wealth of technological, but no bare minimum standard to develop or improve technology training. This lack of standards needs further investigation.

Technology and its use, its purpose, and its meaning are not well integrated to achieve a common and specific purpose. Computer technology in particular is considered productive, simple, universal, and free from the social problems that exist in schools, offices, and factories. However, there are no satisfactory answers for questions such as "How does information technology make learning easier" and "Does it provide improved learning and teaching?" The problems involved in learning, teaching, technology, and management are intricate, complex, and have no universal solution. They are not stand-alone variables. Some overlap. Others are intricately related to social, technical, and professional practice.

The value of considering the human equation/the human moment in technology is not in comparing the efficiency of machine and human being in learning or solving problems but rather in giving recognition to the learning processes and dignity to learners. Human beings, through their learning processes, recognize when they are doing something wrong and can avoid mistakes in the future. Human beings are resilient; they put facts in context, they identify lists from a database, and they cope with uncertainties by using pattern detection. To develop these abilities, a new technological tradition that places learning needs, skills, and potentials at the forefront is highly recommended. Human qualities are put to their best use when people are given time to learn, supported in learning, and given the ability to share information. We have to

recognize that electronic facilities and electronic classrooms can bring the latest list of files and databases but move human contact and exchange to the background.

A new technological tradition needs to recognize the boundless plasticity of human nature. The goal must be to enhance human skill rather than diminish it. For this purpose, we need to know for whom and under what condition new information technology will enhance computer skills. To answer this question, one needs to go beyond interface, interactivity, and Internet. It is possible to modify, improve, adjust, and create an effective learning environment. The issue is how to make the first day with computers a learning opportunity.

The use of relevant, timely methods found in social informatics and adult learning will allow us to better use existing training resources to maximize and recognize the flourishing informal learning methods so that users, learners, trainers, and teachers individually will mix formal and informal learning opportunities. To encourage this approach, the following section discusses concepts such as learning environment, the need for a human-centered computer system, and the possible contribution of adult learning to computer education.

Suggestion: Adult Learning Principles and Methods

The common beliefs, basic assumptions, and value commitment most adult educators have about learning are commonly stated as the adult learning principles and methods. These basic assumptions are:

1. Adults learn best when they feel motivated to learn and when they have a sense of responsibility for what, why, and how they learn.
2. Adult learners are problem centered and tend to think of themselves as users of instead of recipients of knowledge.
3. Adults are ready to learn something that will help them solve problems arising from their work and social roles.

4. Adults have accumulated experiences that serve as a resource in the learning process.

Some educators present the principles of adult learning as: presage (prior knowledge, motivation, ability, curriculum, method, climate, assessment), process, and products. Others present the principles and methods of adult learning as support, inform, and affirm. In terms of end-user training, the focus is on effective adult learning practices that cut across various educational and training settings. Garavan and McCracken (1993), citing Rakes, show effective adult learning in end-user training to involve the following activities:

* showing how new computer skills and knowledge relate to what adults already know,
* making sure that the material is meaningful,
* showing concern for users,
* helping learners be active participants,
* encouraging them to ask questions, and
* knowing whether users are motivated to learn.

The starting point in the adult learning process is stated by Mark (1989) as "highlight the positive: build unconditional self-esteem and motivation via positive reinforcement" (p. 48). What emerges from serious consideration of adult learning principles and methods is a guide that will help a facilitator take learners through a transition stage at a comfortable pace, use personal stories that may help learners break fear about computers, keep activities simple, explain jargon, and, most important, be patient. These are basically about creating a learning environment and facilitating adult learning.

Adult education literature indicates that, before a person can learn, there must be a climate conducive to this learning. This focus on a climate is related to educators' main question, "What is the process that unfolds as

people learn?" In the case of computer training, this means observing what is happening during the first encounter with computers and then following the learner; it is observing people who do not know computing but use computers in their daily work.

An important element during the first encounter with computer technology is fear and distrust. Fear of personal inadequacy, suspicion, conformity, and resistance to the initiation of learning is common (Carroll, 1987). This is why creating a learning environment and building trust are important first considerations in adult learning and teaching. Trust is produced in a climate that includes openness, willingness to share, and respect for human dignity and ability. In such an environment, learners feel they can communicate and be listened to actively and not laughed at or treated as odd or different. It is a climate that supports and encourages the learner to know or feel that he/she is among people who care and in an environment that enables their success in learning.

The essence of adult learning is:

1. helping the learner understand how to use learning resources,
2. creating a conducive learning environment characterized by comfort, mutual trust, and acceptance of difference, and
3. encouraging active participation through valuing learners' past experience.

The process of adult learning is a collaborative activity. To achieve this goal, most adult educators consider the issue of creating a learning environment as an important first step to initiate learning.

Learning Environment

Environment is the total ecology: the physical and material aspects of space plus the social dimensions and dynamics that enhance or impede

learning. The ecology of the study areas is the sum total of physical comfort, climate setting, and classroom arrangements (Heimlich & Norland, 1994). It is a place where learners may work together and support each other as they use a variety of tools and resources in their pursuit of learning. For Draves (1995), the learning environment embraces the learning room, teaching tools, and learning media.

Galbraith (1991) addresses the issue of a learning environment in terms of creating a nurturing psychological climate. According to Galbraith, sound adult learning process is achieved in a climate that "suggests mutual respect, collaborativeness, mutual trust, supportiveness, openness to challenge, risk-taking, pleasure and friendliness" (p. 20). He considers the issue of a learning environment to be what happens or what contributes at the first session to establish a supportive, challenging, friendly, informal, and open atmosphere.

Knowles (1980) in particular, uses the term *educative environment* as identical to learning environment/setting the climate. Knowles discusses the characteristics of an educative environment conducive to learning. Setting the climate for learning includes the way learners are greeted, oriented, introduced, and treated by the instructor. Setting the climate involves asking learners what they are, who they are, what special resources they have, and what questions, problems, and concerns they have.

In learning and teaching, the environment is critical. The initial encounter with computers (the initial phase of learning to use computers) is a period of crisis, during which feelings of self-efficacy play a crucial role in determining who will drop out and who will not stay with it (Nahl, 1998). Hoff (1979) calls the problem in learning environments *education shock,* a state in which a substantial portion of the learning environment is new to those experiencing the situation and a condition in which the learning situation is distressing. Part of education shock is "a clash of expectations," (Hoff, p. 130) which is the result of

having a curious and mythical view of classroom environments, computers, learning, and learners.

Vella (1994) describes this myth thus: "the world of computers is still a fearful unknown to these venturesome" (p. 193). She says of her experience with computer training: "the mass of information frightened me off and I became another statistic: another... learner who began a course and then dropped" (Vella, p. 14). Vella indicates that the learning environment was not a place where her learning was fostered and supported. Freeman (1975) considers an environment where learning is not fostered and supported for women learners as a *null environment,* an environment where there is no connection for women. The experience of Vella and the work of Freeman validates the findings of Beer and Darkenwald (1989), who concluded that a "climate that is not appropriate for adults will not facilitate learning or lead to satisfaction with the learning" (p. 33). Unstructured-use environments in computer classrooms result mostly in boys dominating the access and use of computers, which can potentially generate anxiety among female students or force them to quit learning.

What makes climate setting an important first step in learning is that it brings a sense of security and trust to the learner and the facilitator. Trust and security help reduce conflicts, apprehension, and misunderstandings common during the first encounter with computers. The nature of the classroom social climate affects not only learning outcomes but also the persistence of adults in educative activities.

The Need for Learning Environment

Computer-use environments are where one observes what the anthropologist Pelissier (1991) calls a *great divide:* the modern, the advanced, the sophisticated, and the fast versus the primitive, the crude, and the slow—in short, a fertile ground for conflict. The relationships in computer use environments are mostly hierarchical and involve power

and control. The gap is wide between the expert and the user, the learner and the resource person in computer learning labs.

Kling and Scacchi (1980) note the difference and the clash in computing environments as "supportive" managers, "clever" programmers, "indifferent" machine operators, "career-oriented" auditors, "stupid" users, and "foot dragging" vendors (p. 260). The environment and the implementation of computer systems mostly legitimize the experts' preconceived notions and beliefs regarding technology in education. This is mainly because the implementation of IT, the learning manuals, and possible problems from the experts' point of view leave no room for considering uncertainty, complexity, uniqueness, and unforeseen emerging problems.

Computer experts define problems and present solutions in a short period of time without regard for people (skills) involved. What most experts consider simple is often found by users to be difficult, because each new task requires significant restructuring, reformatting, and error correction . In computer environments, the opportunity to interact, to learn from each other, and to help each other solve problems is possible. But with young and fast computer specialists, as Snow (1963) notes, "the politeness has gone" (p. 23). Mandefrot (1997) depicts this situation as "you ask the info people something. The reply is 'don't you know that yet?' I am ashamed and stopped asking anymore" (p. 192).

Conflict and apprehension are realities in the learning process because there is no learning without emotion and challenge. However, technical interests and analysis deny or try to control this reality. To minimize noncognitive elements such as sentiments, emotions, and interest and to consider hardware and software as primary have a long tradition in computing. This kind of situation at times leads a learner to feel like an outsider. Designers, for example, oversimplify the need for environmental analysis. Yet, the learning environment is a profile of where instruction occurs, who uses it, and how it is used.

Climate setting in adult learning reduces conflict and apprehension by bringing a human dimension to the learning process. For the computing session, it helps fight misconceptions about computers, unfreeze fear, and build learners' confidence. A step-by-step introduction of adults to the physical machine and the software reduces the chance of jumping onto the machine and getting frustrated and facing what is called the *production bias* or *production paradox.* Kluckhohn (1942) considers such a problem a result of rushing learners/workers to new concepts or tasks without support and without building their confidence. To smoothly introduce learners to the world unknown to them, most adult educators use the process called *facilitating adult learning.*

Facilitating adult learning is a process of creating a learning environment and helping adults learn. Hammond (1990) extends effective facilitation to include providing the learner with a framework, ensuring the learners' current assumptions, and creating new opportunities for learners. This is why adult learning principles and methods are so necessary for learning and using computers. The next section presents these needs from the perspectives of computer experts' need for human-centered systems, and educators' need to help people learn.

Why Adult Learning Principles and Methods?

The need for adult learning principles and methods is significant because of the common needs and problems in computing environments experienced by computer experts and the learning problems commonly observed by educators. Today's computer experts are calling for a human-centered system. Concepts such as *facilitating learning* and *mentoring* currently appear more in computing literature than in educational literature. The purpose of a human-centered system is to provide learners with a guide to make sense out of a vast amount of information. For example, Davenport (1994) recommends humanizing information management. Morris (1994) calls for a user-centered information service. Maruyama (1984) calls for humanizing the

applications of a computer. Kling, in his various publications (Kling, 1987; Kling et al., 1998; Kling & Scacchi, 1980, 1982), continually indicates the importance of approaching computers as a social practice.

The emphasis in all these recommendations is for a balance among technology, organization, and the user. The issue in all cases is how to help users get awareness and how to help them acquire computing skills and knowledge so that they can use computers with manageable problems. What Maruyama (1984) calls "humanizing application of computers" (p. 634) is a search for a nurturing learning environment that encourages learning from each other while working together. It is a means to knowing the user as a human being. However, the use of adult learning principles as a means to achieve the above purpose, though common in management training, is not common in computer training. This absence of adult learning principles and methods in computer training is related to the various claims about technology and the computer culture that tries to minimize human involvement in most computing activities. Boland (1987) considers the removal of human actor from computing and lack of serious consideration of a learner/user a fantasy and states that "the fantasies lead us to ignore the fundamental nature of interpersonal dialogue in the achievement of meaning. … Through our image of information we are fostering an image of the world in which human meanings of knowledge and action are unproblematic, predefined, and prepackaged" (pp. 363–365).

As a result, most technical analysis and technically oriented literature cannot raise a serious question such as, "How can we help a computer user become more knowledgeable about computers?" Technically oriented approaches remain unable to value the importance of adult learning principles and methods when most computer learners are adults.

Today, a reluctance by the experts to accept collective learning and to understand the user has resulted in current misunderstandings in the computer use and learning environments. Oz (1994) classifies these misunderstandings as corresponding failure, process failure, interaction

failure, and expectation failure. In terms of end-user training and adult learning, these failures are the result of mismatched objectives, outcomes, lack of skills and resources, low user interaction and involvement, and vaguely expressed expectations for training. Correspondence failures usually occur when the needs of end users are ignored. Interaction failure is the outcome of "corporate directives that the employees must use the system" (Oz, p. 34).

Robbins (1995) traces the historical and systemic nature of the turbulence in the field of information technology—turbulence that forces it to neglect the realities of learning from each other while working together—and the need to develop positive interaction with users. Robbins states that "we continue to resist new thinking, and we criticize what we do not understand, we pretend to listen to our customers (our audiences) but we ignore their basic needs unless it suits our personal agenda" (p. 16). This statement illustrates the contradictory situations in the computing environment and what has made computers and computing an "incommunicable art" (Snow, 1963, p. 47).

Learning and using computers was made incommunicable because the process lacks an appropriate learning climate, sequence, and structure. Most approaches to computing minimize the elemental needs of learning and using computers, such as steps and structure in the learning process. Dickinson (1973) indicates that the ordering of any learning task is an important factor for effective learning and suggests the following arrangement for sound instructional process/sequence: from simple to complex, from general to specific, from concrete to abstract, from familiar to unknown, and from most to least frequent. This approach to learning is in line with the hierarchy of learning suggested by Bateson (1972) and the different phases of meaningful learning identified by Shuell (1990).

Tuckett (1989) presents a hierarchy of information skill as progressing from simple information skills to compound information skills and then to complex or integrated information skills. On the other hand, Eason

(1989) presents the learning needs of office workers and modes of promoting learning and particularly stresses what he calls *pre-use learning,* which is related to the problems that are critical during the first encounter with a computer.

Eason (1989) states that "new users make extreme and unrealistic assumptions about the technology and are very nervous about their ability to cope with it. … The familiarization sessions before implementation... can be extremely valuable" (p. 236). To this effect, Eason considers the aim of the first session as a preparation "to set people up for learning," rather than teaching the entire application in one day. Setting people up for learning means creating a learning environment and giving some directions for learners. It is facilitating learning and helping people learn by building their confidence.

In addition to initial training, computing requires continuous education and refresher courses. People who use two or more software packages and are more casual users need skills maintenance (Eason, 1989).

One reason the need for adult learning has become so important for end-user training is identified by Geisler (1992), who considers "every investment in information technology as a voyage into frustration" (p. 76). Defying the notion of easy to use and easy to learn, Geisler warned computer experts that the human problems in computing needed what he called the three T's: time, training, and tolerance.

According to Thomas (1991), the main characteristics of learning are:

* learning takes time,
* learning is irreversible,
* learning cannot be done overnight by magic,
* learning is not coercible, and
* learning derives more from other people than from one person.

These characteristics cannot be easily developed by using advance interface, clicking the icon, or simply by asking the expert. Humanizing computer applications and making learning about computers possible demand moving beyond measuring computer anxiety, user resistance, and user satisfaction. The basic problem behind computer anxiety, user resistance, and user dissatisfaction is lack of skills, a lack of knowledge about computers, and lack of sound adult learning methods.

Lewis (1998) studied more than 650 adult basic education students who were traditionally characterized as having a low self-concept and negative educational experiences. The adult learning environment was credited as a major reason that Lewis found that the students were both interested in and comfortable with computers. According to Lewis, this environment was created by following "principles of good practice and teaching techniques that facilitate learning" (pp. 7–8). Some of these principles of good practice are:

* demystify the computer,
* start with the basics,
* attempt to ascertain the learner's worst fears,
* recount your own personal experience as a beginning computer user, and
* avoid jargon or buzzwords.

The points that Lewis (1988) stated as principles of good practice involve creating a learning environment and moving learners smoothly through the learning process—in short, building learners' self-efficacy. These principles are what Bronsema and Keen (1983, pp. 38-40) call *educational intervention.* Educational intervention is effectively helping people through the learning process. According to Bronsema and Keen, educational intervention involves showing commitment (p. 38), creating a forum for dialogue (p. 39), taking action and changing words into action, sequencing events (p. 40), and closing the cultural gap (p. 42). This is similar to Lewin's (1947) change process of "unfreezing" to

heighten awareness, clearing some misconceptions we have concerning technology; moving participants in the learning process slowly from basic to advanced concepts, and "refreezing" the process. From Lewis' study, it was possible to see that the lack of such help during the learning and using process generate computer-phobia and user resistance. Unfortunately, so far, these approaches have rarely been used in computer training programs.

Lewis' (1998) recommendations are comprehensive and include important issues raised by different researchers in this area. The suggestion by Lewis addresses important features of learning largely neglected by information technology experts and that give learners a difficult time learning and using computers. These important features—creating a learning environment to develop security and trust, building learners' self-concept, respecting the individual differences of learners, recognizing learners' fear, reassuring learners that it is ok to make mistakes, giving structure, and using different teaching methods—are all considered within the context of Lewis' *principles of good practice.* Building learners' confidence, in particular, when the learners are lower-level workers and older adults, is critical. These learners, though having the potential to learn to use computers, often lack confidence in their ability to master a new technology.

What is clear in Lewis' (1998) approach to teaching and learning about computers is the way she approaches motivation and the need for mixing instructional methods. In Lewis' approach, one can see that good teaching cannot be prepackaged, and an environment where cooperation and understanding of each other is possible can be developed, as far as the goal is to build comfort and confidence and to make computer training an opportunity rather than a threat. Her point is to make people ready for a computing journey using all possible methods. Another goal is to give structure and confidence, and provide a road map for further learning. Kraybil (1974) notes the importance of giving structure: "once the structure of a subject is exposed, an individual can then acquire other details throughout life with which to elaborate structure" (p. 335).

Lewis (1988) also identifies one important element about self-directed learning or computer-based training for adult learning. She recommends a mix of delivery patterns. Similar to Lewis, Steinberg (1989) indicates the value of mixing methods and the need for balance in approaching learning and teaching. Considering Lewis' approach, understanding (accepting) the common attitudes and patterns that exist in use and learning environments, valuing the elemental learning needs of learners helps to make learning and using computers easy and possible.

Conclusions and Closing Questions

In the process of writing this article, I came across some questions consistent in most literature. These are:

1. Why is it that a statement such as: "I am very happy I took this course. It demystified the computer for me" is not very common, while training and user satisfaction are so common?
2. Do educators know why and understand how technology enhances or hinders learning when we recommend online learning or computer-based training?
3. How long will managers continue asking employees for polished documents without asking themselves how well they have helped employees learn to use computers?
4. How long will managers continue to say our technology is great but the ability to use it is limited?

These questions are not limited to the educational sector but are also relevant to business and industry. In one way or another, they are about the learning and use environments. Understanding these questions helps to see how users and learners look at, feel, and behave with a given technology. By examining these questions from different perspectives, we not only gain insights into the dynamics of learning and using technologies but also find new understanding of people, technology, and

organizations. With this new understanding, the difference between what is technical and what is human for a clerk or computer expert can fuse together.

Empirical evidence suggests that learning to use computers remains difficult for the following major reasons:

* lack of a learning environment in which learning and learners are seriously considered,
* lack of caution in technology introduction,
* lack of basic infrastructure for learning,
* lack of modest expectations as to what can be achieved, and
* lack of listening to and helping users.

Learning environments are not technical aids that make people learn or create learning. Environment delivers tips and can rekindle learning. Chilly climates, unsupportive learning and use environments, isolation, lack of confidence, and negative human relationship all block the will and ability to learn. Past experience has informed us that having a handful of highly educated and dedicated people in systems will not solve the current learning problems. Current problems in learning and using computers cannot be solved with one method and one perspective. So far using one method, one metaphor for learning, and one perspective has not created a learning or use environment that encourages people to learn. It is not more technology, faster processors, new browsers, and new software that will improve learning and using computers; rather, learning will improve because of more-nurturing learning environments, learning resources, support, and human-to-human interactions.

Seeking simple definitions and easily measurable variables and making behaviorally or cognitively based distinctions are not helpful to understand learning. Clear, explicit, and universal (overt) learning theory on how people learn and how learning takes place is still not available. Learning theories do not always have global significance. Learning is

not a simple concept that can be treated with one metaphor and one point of view. In this context what is important is understanding the three pillars of learning (the learner, the teacher, and the environment) and their relation and interactions.

The lack of state-of-the-art technology and highly skilled technical staff makes effective learning and use of personal computers difficult. Leiss (1990) reports that mere possession of capital is no guarantee that the requisite talent can be obtained and organized. Organized capital needs organized learning environment. This means organizing adult learning, building a learning infrastructure, and setting realistic expectations for learning.

The need for adult learning is high, but too little attention is paid to learning at the workplace. With all the problems and misunderstandings, users and computer trainers are making sense of the computer. My personal experience as a trainer, researcher, and learner convinced me that, as stated by Pascale (1990) "all that is essential is courage, persistence, and management openness to learning" (p. 261).

This article has approached technology as a form of human cultural activity. In this context, information technology is considered to be more than a simple, ubiquitous, objective artifact; rather, it is endowed with purpose, problems, interest, and meanings. The focus in this approach was on understanding the claims and counter-claims regarding information technology and on learning and identifying major problems that are making the use and learning of computers difficult in business, industry, and education. To demystify computing, claims and counter-claims have been presented, with some problems in technical analysis in relation to learning. This article has also presented the gap between technical experts and end users, which prevents non-technical staff from understanding IT and technical staff from appreciating what is wanted.

Finally, I have presented ways in which learners can be encouraged to learn and how to provide opportunities for sharing experiences using

adult learning principles and methods. To develop mutual understanding and to distinguish the myth from reality in computing environment, I suggest considering learning infrastructure, creating a learning environment, and using adult learning and teaching methods as an important part of investment in information technology.

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