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Web-Based Distance Learning and Teaching: Revolutionary Invention or Reaction to Necessity?

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A Systems Analysis of the Workplace of the Future

In order to try to make sense of the future into which we may be moving, we could do worse than to adopt the well-tried and tested "systems approach" for the design of a scenario of the educational and training systems of the future. As a first step in this process, we must perform a systems analysis of the "end-product" of the proposed new educational system, that is, the new type of "knowledge work" that it is postulated will become prevalent in the networked society of the 21st century.

The knowledge worker is somebody who earns a living by using knowledge in order to create new knowledge. The knowledge worker must have well developed capabilities of critical analysis in order to be able to select from the vast array of available information that which is of relevance and value, and a high measure of creativity in order to invent or develop the new knowledge that may offer a competitive advantage to his/her organization. In the future fast moving and open information society, this advantage will not last very long before the new knowledge becomes public knowledge and many people or organizations may act on it. Therefore, the task of knowledge workers is to continually renew the process of knowledge creation, thus keeping themselves, or their employers, ahead of the competition.

Such high levels of critical insight and creativity are what traditionally single out the exceptionally intelligent human beings from the rank and file. However, as computer software becomes more capable and intelligent and replaces many of the routine tasks formerly performed by human beings, then maybe the only area of future occupation where human beings will excel will be in this form of creative knowledge work. The goal of the aspiring educated human being may therefore be focused ever more on the acquisition of the necessary skills to be a successful knowledge worker. The purpose of this chapter is to investigate in what way such a societal trend, if indeed it comes about, would affect education training needs, processes, and, particularly, delivery systems as we move into the next century-

The basic conceptual model of a 'system" is some "process," acting within some "context" from which it acquires resources or "inputs" and to which it delivers results or "outputs." In our case, the process component is our knowledge worker or, if we wish to take a broader view, an organization which is keeping abreast of its competition by engaging in knowledge work. The principal input to this process is the existing knowledge or information that has already been discovered, organized, and made available in meaningful and useful ways. However, the amount of Information in the world in general is estimated to be doubling every few years. The more information there is, the more it tends to become difficult to find the specific information that may be of particular relevance to a particular activity or problem situation that we may be facing at a specific point in time. We are faced with the paradoxical situation of having to act more quickly in order to keep abreast of change, but, as the total amount of information available to us increases, finding the task of new knowledge Generation more difficult and possibly slower than in the past.

If we now turn to the output side of our system, we see a similar dilemma. The expected output from knowledge work is some form of creative and unique solution or suggestion for "keeping ahead of the competition." We are faced with the paradoxical situation that all of us, as individuals or organizations, will be forced to adapt faster and more creatively to an ever changing environment in order to be able to survive and prosper. On the other hand, this very activity of rapid inventive knowledge Generation and its implementation in order to keep abreast of change will contribute to the acceleration of the process of change within the environment, thus forcing us to adapt and invent still more.

We therefore see, both on the input and the output sides of our system, that the impact of new technologies, on the one hand, offers us tools with which to deal with the new challenges that a changing society or workplace presents and, on the other hand, those same technologies actually are responsible for the changes that are generating these new and ever changing challenges. Is there a danger that these forces for ever faster and greater change may lead society to a point where the whole system disintegrates? Such catastrophes happen in electrical, electronic, and other types of engineering systems when there is an absence of an effective control system.

The general systems theory principles of homeostasis and regulation suggest that a control system, to be effective, must be similar in complexity and variety to the system being controlled (Ashby, 1956). This implies that whatever regulatory systems exist in society as a whole, every process component must possess its own self-regulating mechanisms. For example, government Legislation and controls cannot hope to control the directions of change in future society without the cooperation of the economically active organizations that compose the society. And these organizations are not fully "under control" If their key workers do not collaborate participatively toward the same set of global objectives. In short, the responsibility of the knowledge worker goes beyond the creation of new knowledge in order to deal successfully with environmental change, but encompasses also the judgment of which changes should be promoted and which should be controlled in order that the overall system does not get into a state of disequilibrium. How may the knowledge workers of the future develop the abilities to control change so that it may be beneficial to the majority of citizens as well as to the organization that employs them?

The often suggested answer to this sort of question is "through appropriate education and training. " But what are the skills and competencies that the next Generation of the world's citizens should master in order to become effective and responsible knowledge workers? And what are the key methodologies of the educational systems required by society in the 21st century in order to implement this new curriculum? In order to form a model of the curriculum, we once more start by conceptualizing the outcomes of this future educational process, that is, the key competencies of an effective knowledge worker.

Self-Directed and just-in-Time Learning

One increasingly important competency in the future society will be "self-directed-learning." Much emphasis is being placed in modern school curricula on "learning to learn," as a response to the realization that in the future, learning will be a lifelong occupation, largely occurring outside of the formal educational institution (Benson, 1994). One area for lifelong learning, already evident in modern, highly computerized organizations, is the need to continually learn to use new tools for the accessing, processing, and transformation of information into new knowledge. These tools today typically take the form of software application packages. The very rapid rate of substitution of these tools and their increasing sophistication has led to a significant conceptual reorganization of the training function in such environments. The talk today is of 'just-in-time training" (Carr, 1992; Goodyear & Steeples, 1992; Plewes, 1992). just as the concept of just-in-time inventory control in business management signifies an attempt to keep stock levels very close to the levels of utilization, so that purchases are made just when required, so in the area of knowledge and skills acquisition through training, the just-in-time concept argues that the person who requires a new skill should learn it at the time when it is required and never before.

Just-in-time training, in its implementation, implies a high level of individualization and self-direction in the training and education processes, so that each individual may learn just what he or she needs at the time when he or she needs it. Almost by definition, this implies a radical change in the training delivery systems from place-based and time-fixed group instruction (characteristic of our conventional education in the past) to on-the-job distributed training that may be utilized, under learner-control, at any appropriate time or place. This, in turn, implies the use of technology-based training delivery systems (Benson, 1994).

The just-in-time training concept is congruent with the general principles of "performance technology." The identifying characteristic of the performance technology approach is to relate all training and education activity to its effect on relevant job-related performance that may be measured, tracked, and evaluated on a regular basis (Clark, 1994; Gilbert, 1978; Langdon, 1991). In the performance technology approach, training and education are but a part of the total armory of techniques for enhancing and maintaining human performance in the organization. Other techniques are: just-in-time information provision in the form of reference material or job aids; improved incentives; improved feedback on the results of performance; appropriate consequences (both rewards and punishments); and so on (Davies, 1994; Gilbert, 1978; Harless, 1992; Rossett, 1992). In the networked environments of modern organizations, and, increasingly, even in the home, access to information-sharing networks (including, but not exclusively, the Internet) is providing a medium capable of furnishing all manner of relevant information to the worker at the place of work, eliminating much previous travel to courses, conferences or libraries.

Self-Directed Knowledge Acquisition and Hypermedia

However, that is not the whole picture. On the input side, in order to perform as a creative knowledge worker, the person must first access the information that is available and relevant in order to put it to use. In order to facilitate this process, the information should be available in a well-organized form. The organization of vast amounts of information into meaningful structures is no easy task. The difficulty lies partly in the complexity of analysis required to come to conclusions about how best to organize and present subject matter to a variety of different user groups with different motives for using the information. It comes also from the sheer enormity of the task, given the vast amount of information which is generated every year. Finally, it comes from the difficulty of arranging access to the resulting vast libraries of information for the potential end-users.

A technology-based solution to these issues has appeared in the form of hypertext or hypermedia systems. The concept of a "universe of Information" composed of electronically interlinked documents was suggested by computer scientists as early as Bush (1945). The concept was realized in practice by Englebart (1963) and Nelson (1965). However, it was only in the last decade or so that the large-scale implementation of the concept has resulted in practical hypertext systems becoming available to the public at large (Conklin, 1987; McAleese, 1989).

The World Wide Web is the latest embodiment of hypertext/hypermedia environments, allowing the practical implementation and use of hypertext environments to graduate from the relatively small stand-alone systems, previously developed with tools such as HyperCard or ToolBook, to much larger and universally available systems of structured Information.

The Metacognitive Skills of Information Analysis

Another important aspect to consider is that of the skills and capabilities required by the knowledge worker in order to locate and assess the value of specific items that are "out there" in the expanding universe of information. The skills of locating information in a complex and vast library are not easy to master. However, the user can be helped by a combination of systems for the organization of information and for online help.

A second set of skills, also not that easy to master, is necessary for the analysis and evaluation of information, once it is located, to judge whether it is useful for the particular task which one is trying to accomplish. These are the "critical thinking skills" that most educational curricula attempt to develop, but at present only seem to succeed in actually doing with a small proportion of the population. However, as we move into the age of the knowledge worker and the knowledge organization, the importance of these skills will increase. We may even reach the situation in which only those human beings who can demonstrate a high level of skill in critical analysis will be likely to hold down a challenging and well-rewarded job. Therefore, improvement in the effectiveness of education in this area of skill-building is a critical issue.

Critical-analysis skills development is the area of research that has concerned many cognitive scientists in recent years. One aspect of the problem is concerned with making sense of the information available. However well-organized and well-communicated some of the information sources may become, it is unrealistic to expect that all information generated in the world of the future will be written by expert communicators, or be subjected to analysis and reorganization by instructional designers. It will often fall on the end-user to make sense of imperfectly structured and communicated information sources. Research on techniques of information analysis, such as Concept Mapping (not to be confused with Information Mapping, which will be discussed later) has demonstrated the Potential for improving students' information analysis and comprehension skills (Novak, 1991; Young, 1994). These techniques are now being applied both to the improvement of electronic online communications by the incorporation of concept maps as a form of advance organizers, content guides or browsing tools in online information resources (Reader & Hammond, 1994; Schroeder, 1994), and to the development of improved skill in dealing with online study materials by special preparatory concept-map drawing exercises (Naidu & Bernard, 1992; Russell & Meikamp, 1994).

The Skills of Creative Problem Solving

Let us now move from the input-output (Information and performance) considerations that we have been addressing once more to the "process"; that is, the activity of the knowledge worker when utilizing relevant available knowledge to create useful new knowledge. The role of the knowledge worker will be to add value to existing knowledge by transforming it into more application-specific knowledge that, for a time, will be the unique property of that individual or organization. This highlights yet one more critical set of thinking skills. In addition to the skills of analysis, used to identify relevant knowledge and the skills of evaluation to judge the usefulness of this knowledge for the task at hand, the knowledge worker must possess skills of synthesis, or the putting together of ideas in novel ways in order to create new ideas.

We are here using the terms of Analysis, Synthesis and Evaluation as used in Bloom's taxonomy of objectives in the cognitive learning domain (Bloom *et al., 1956)* to describe the higher order outcomes of learning associated with creative or productive thinking. The fact that Bloom's taxonomy has been around for a long time as a theoretical construct for instructional designers does not imply that education and training systems necessarily always do a good job of developing these creative thinking skills. As we progress into the 21st century, however, the importance of appropriate strategies and methodologies for the development of these three categories of creative thinking skill will become increasingly important. It may be argued that this is where the core curriculum of any basic schooling system should focus its attention in the future.

The above-mentioned observation, that educational systems may not always do a good job in the area of higher-order thinking skills, should not be taken to imply that there is no known methodology or technology appropriate for their development. Many successful programs for the development of critical thinking skills have been developed and implemented. Analysis of such programs reveals that they tend to have certain characteristics in common. They tend to use "experiential learning" techniques. That is, they tend to set up learning situations which present a problem or a complex task for the learners to deal with and then encourage and assist the learners to draw general conclusions and establish general principles that may explain or predict across a range of similar situations (Romiszowski, 1981; Steinaker & Bell, 1979). One teaching methodology that is particularly successful in the development of critical thinking is the case study method. This typically puts the student in an experiential learning situation of having to deal with a real or simulated problem situation. Study of the specific case then leads to a discussion in which general principles and concepts that underlie the case are identified and then tested out on other case examples for verification of their general validity. Other techniques used for the development of critical thinking include small-group discussions, simulation games, project-based work, and collaborative problem-solving activities. It may be noted that most of the techniques known to work in this type of learning situation involve small-group interaction, in-depth discussion, a lot of interchange of between the participants, and an approach to the conduct of the teaching-learning activity that is flexible, collaborative, and "conversational." Another term that is often associated with this group of instructional techniques is "experiential" learning (Romiszowski, 1984).

The Areas of Competency, and Related Technologies

To summarize so far , we note that the mix of key competencies that are required by tomorrow's knowledge workers involve performance-related competencies, not only in terms of successful and creative solutions of novel problems but also in terms of efficient and rapid learning of the use of new tools and techniques that are constantly appearing in the job environment. In this area, the relatively older traditions of instructional design continue to be relevant and useful. It is possible to identify specific knowledge and skills required in order to master the tools of the job. The one difference is that as the tools are replaced at ever greater frequency, the emphasis in the teaching/learning process is on quick, just-in-time learning. The emphasis is also on not learning the details of utilization of a tool if some sort of on-the-job reference or performance support system proves to be adequate.

On the input side, the skills of information access, location, analysis, and evaluation are of importance. Here we may see the need for better Information Provision through better structuring and online support of tomorrow's electronic libraries, through better authoring of the materials to be included in these libraries, and also through improving the skills of out citizens in dealing with complex and vast libraries of information accessible over networks from a distance.

In the middle, between input and output, is the process that transforms existing knowledge into new knowledge. This is seen as the major point of importance in future educational Provision for the citizens of a highly technological and networked society. In this area, the relatively well established methodologies of experiential learning and reflective learning are seen as the best available models at this time.

Delivery Technologies for the Future Curriculum
Electronic Performance Support Systems

Let us now consider some of the technologies and some of the methodologies that may be of particular relevance in each of the areas of critical competence that we have identified. To start with the output side of our picture, the performance technology approach to design typically uses a mix of instructional materials and reference or job aid materials to support the performer in the job situation. In future networked societies, it will be ever more common to find that both the training materials and reference materials are in fact electronically stored and distributed. This performance-support software that may be either stand-alone, for example a CD-ROM disc accessed on an individual personal computer, or may be networked from some central server to many users. This trend to online performance support is a natural tendency, not only because of the Potential benefits that electronic delivery and control of learning and reference materials may have, but also because in the networked society or job environment, the computers and networks are already there for other reasons and it is both economical and convenient to use the same tools and distribution systems for learning and reference materials. As this tendency developed, we have recently seen the birth of a new form of instructional technology, which has gained the name "Electronic Performance Support Systems" (Gery, 1991; Milheim, 1992; Stevens & Stevens, 1995).

An Electronic Performance Support System, or EPSS, is an integrated system of training and reference materials, possibly some software tools, such as special-purpose spreadsheets or simulation "shells" for testing out hypotheses, and whatever else may help to both develop and maintain the performance of persons carrying out a particular set of tasks. This integrated system of job-related information is delivered to those persons, online, as part of the software that supports their job, by means of a general purpose computer/workstation that typically performs other job-related functions as well.

In many current applications of EPSS, the delivery medium is a local area network of computers owned by the employing organization. But, as the EPSS philosophy spreads (as it undoubtedly will) to supporting human performance in more general areas of activity, not necessarily linked to a persons' principal employment, but maybe to their hobby interests (e.g., auto maintenance) or home activities (e.g., parenting), such online support systems will increasingly be available as publicly accessible services on the Web. And many organizations, as they turn to the Web as an alternative method of networking within the organization (through the creation of Intranets within the Internet) the Web will become the vehicle for delivering job-related EPSS to the workers.

Multimedia, Hypermedia, and the Web

On the "input" side of our picture, growth in the provision of hypertext and hypermedia systems and the implementation of powerful networks (such as the Internet and the promised future information superhighways) points the way in which technology is leading us in relation to the organization, storage and distribution of information to end-users. Although we are not yet there, the promise is that in a short time, most citizens of the world will be in a position to economically access just about any information in the world. Although the technology enthusiasts may be a little over optimistic in terms of timelines, the signs are that we are heading towards much cheaper and more democratic access to the world's stores of information.

Whether this trend will mean an improvement in how society actually uses information is yet to be seen. The evidence from countries where multiple channels of television are normally available is that most citizens use only a few of these channels on a regular basis. If today the typical USA resident regularly uses only four or five out of the forty or fifty channels that are piped to the household, what may be the position some years down the line when 500 channels are available in every house? Will the citizens still be using five out of the 500 on any regular basis? And if a proportion of the channels is made available either for education or public access information distribution as opposed to entertainment, what is the likelihood that if people choose to access these channels, they will benefit as much as they hoped to in terms of identifying useful information, understanding it, and learning how to use it in practice? Not only will the average citizen require an above-average level of skill in navigating through information networks and identifying points which are worth paying attention to among the so many that are not, but also, the networks of information must be so organized that an average citizen without a superhuman capability of information analysis will indeed have the capabilities of identifying what is out there and which parts of it are of relevance and value.

Most hypertext and hypermedia products have, to date, been "stand-alone" systems, in that although they offer the end-user the possibility of "browsing," or "navigating' a particular knowledge domain in a flexible, learner-directed manner, that browsing is limited to the information documented in a particular CD-ROM or other media package. The vision of Nelson (1973, 1980, 1987) and other hypermedia enthusiasts, of a global system of interlinked information sources that ultimately would provide access to all the world's information resources for all the world's citizens, remained a theoretical construct until very recently. Indeed, attempts in the USA to implement the beginnings of such a system in the mid 1980s, under the name of the "Education Utility" (Gooler, 1986) failed miserably. Now, a decade later, spurred by the explosive growth of the Internet, the concept is entering the realms of practical implementation and use. The World Wide Web, now the preferred manner of accessing the information resources of the Internet, is a hypertext system that allows the contributors of information to create links between their contributions and any of the other documents, or "sites," existing in the system, and allows the Internet users to navigate freely from one site to another by simply clicking on the highlighted indicators of existing links.

How close are we today to realizing Nelson's dream of universal democratic access to the world's information resources? Perhaps not as close as some people would have us believe. There are several reasons for this. One that immediately springs to mind, especially in the context of a discussion taking place in nations such as Indonesia, Brazil, Russia, or Angola, where the telecommunication infrastructure is not as developed or as freely accessible as in, say, Europe, Australia, Singapore, or the USA, is the time and resources that will have to be spent in order to make today's emerging technologies truly available and affordable on a worldwide basis.

A second, more easily overlooked, reason is that even in the technologically "developed" nations, the currently existing infrastructure is not up to coping with the traffic that will result from exponentially expanding use of the Internet, both in terms of information providers and end-users. Already there are signs of the system being over-extended, particularly at certain times of the day. Continuing growth in the size of information resources and the volume of end-user traffic must be accompanied by proportional growth in the capacity of the networks to carry the traffic. This is a not an insignificant investment, even for the richer developed nations.

A third, yet more easily overlooked, reason for caution is the limited capacity of the end-users to find their way through an "exploding universe" of Information in an effective and efficient manner. Finding relevant information in conventional libraries has always been problematic and difficult. The advent of hypertext has introduced an additional set of "micro" problems to the previously existing "macro" issues of information search and retrieval. In addition to previous difficulties of finding relevant documents (books, papers, articles), the reader is faced with difficulties in finding relevant information within the document. One major user problem in many currently available hypertext systems is described as the "lost in hyperspace" effect (Edwards & Hardman, 1989; Yankelovich *et al.*, 1988). The readers navigate in a nonlinear pattern from one "node" of Information to another, following potentially interesting or relevant "links," and soon lose their bearings, as if in a maze, unclear as to where they have .arrived in the domain of study and why they are there. The undisputed technical advantages of making information more easily and more democratically available are to some extent undermined by human skill limitations on effectively using such an information network.

Whereas the responses to the two earlier cited reasons lie in the domains of the technology itself (coupled to economic and political decisions as regards necessary financial resources), the solutions to this third reason lie within the domain of the social and cognitive sciences and the related technologies of communication and education. One future area of work for the instructional systems design and development professional will be in the area of online information systems, to help solve both the "macro" issues of information systems design from the human engineering viewpoint and the "micro" issues of the design of nonlinear, browsable, hypermedia documents that are understandable and really useful to the end-user.

The "macro" level of design will draw strongly on existing techniques for the organization of information libraries, coupled to innovative techniques of providing "librarian support" to the end-user by automated means. This is one of the few areas in which artificial intelligence research has so far produced tangible products, in the form of "expert systems" that effectively and efficiently replicate the user-help capabilities of the skilled librarian (Bailey, 1992; Denning & Smith, 1994; McCrank, 1993; Morris, 1991). These new developments are now beginning to be applied to the design of "search engines" for use in global networks such as the Internet (Price-Wilkin, 1994; Valauskas, 1995).

The "micro" level of design will focus on the principles and procedures for the development of "hyperdocuments" of various types, especially as relates to the organization of information so that it is of the maximum value to the maximum range of possible end-users and, at the same time, organized so that readers may freely navigate from one detailed item of information to another while always maintaining a clear vision of the "big picture" and their position within lt. Among the many attempts to develop authoring techniques for this purpose, the structured writing methodology named "Information Mapping" is an early development (Horn, 1969, 1973) that has proven its power in many contexts (Romiszowski, 1976), and has continued to mature and grow in versatility (Horn, 1989; Romiszowski, 1986).

Computer Mediated Communication (CMC)

At the middle of our systems diagram (the knowledge workers themselves and their process of critical and creative thinking), a technology that holds much promise is Computer Mediated-Communication (CMC). CMC is a much broader concept than "computer conferencing." It includes any form of organized interaction between people, utilizing computers or computer networks as the medium of communication. The attractions of CMC for future educational systems are many. First of all, it is yet one more and particular versatile approach to the delivery of "distance education." There are powerful political, economic, and social arguments that support the extended use of distance education methods in the future.

However, there are other characteristics of CMC that are of value even if the educational process is not or should not be carried out at a distance. For example, the "asynchronous' nature of interpersonal communication in a computer network, where individuals read messages and then respond in their own time, taking as long as they need to think out their responses, holds promise in certain contexts as compared to more conventional approaches to group discussion (Romiszowski & Corso, 1990; Romiszowski & DeHaas, 1989). Although face-to-face meetings may have advantages in terms of interpersonal and social contact, non-verbal communication and so on, they also have disadvantages. They are held in "real time," which apart from possibly making it difficult or impossible for some people to participate due to other commitments or geographical distance, also may limit in some cases the amount of planning and analysis or the amount of participation that individuals who do attend may have time for. They may also limit participation due to various forms of personal inhibition.

CMC is probably the fastest growing area of educational technology research and development at the moment(Romiszowski & Mason, in press). However, we still are not in a position to be able to design CMC systems that will effectively implement particular group-learning strategies with the same amount of confidence that we have when designing a computer-based instruction package or a set of online reference materials as job-performance aids for a project geared towards the mastery of certain job skills. Not are we yet as knowledgeable or skillful in the use of CMC as we are beginning to be in the organization of meaningful networks of information within the electronic communication networks that are beginning to link all parts of the world. Of the three areas that we have identified, the CMC area is the most promising for the development of the reflective thinking and creative planning skills that are required to close the gap between information and performance in knowledge work. However, for the time being, we know little about how to implement CMC for the effective development of creative thinking skills.

It is in the area of CMC, therefore, that the greatest need exists for research and development on the design and development of creative-thinking training programs. Once more, here we meet an interesting paradoxical problem to resolve. On the one hand, we have identified the critical thinking, or creative problem solving, area as being of paramount importance for the knowledge worker of the future and, therefore, ultimately, for the employability of the human race. We have also identified the types of teaching-learning techniques that seem to be most effective in this area. These tend to be experiential exercises followed by interpersonal interaction in small groups, and with facilitators to guide the group towards useful conclusions.

The small-group-discussion teaching-learning methodologies have always been relatively expensive, as they involve small groups of students at one place and time with highly skilled and experienced group facilitators. In the future, with falling technology costs and all manner of distance education hardware/software systems appearing on the market at economical prices, the small group learning methodology will appear as a luxury that we can afford to use but sparingly. Yet it is exactly this methodology that we currently know how to use effectively for the development of critical-thinking skills. The paradoxical situation, therefore, is that in the changing technological and economical climates as we move into the 21st century, we may get less and less of what we need more and more.

As the impact of technology on society is at least partly to blame for this paradoxical problem, it would be appropriate if we could find a solution to the problem within that same technology. Over the last few years, a number of research studies have been performed to investigate the utilization of the case study methodology within computer networks as opposed to small group meetings (Romiszowski, Grabowski,

& Damadaran, 1988; Romiszowski, Grabowski, & Pusch, 1988; Romiszowski, 1990; Romiszowski & Chang 1992, 1995). The results of these studies will not be repeated in detail here. However, it is important to highlight two emerging conclusions. First, if properly planned and implemented, computer-mediated conversations may be just as effective as small-group discussions for the development of a wide range of higher-order decision-making and planning skills. Second, the key to the design of effective instructional CMC environments may be found in the application of a scientific theory of conversation. In addition to Instructional Technology, Performance Technology, and Information Technology, the field should develop and apply a Conversation Technology.

Conclusion: The Real Meaning and Importance of Networks

A principal tenet underlying the structure and content of this book is that the global network of computers, enabled by the Internet and currently most effectively embodied in the World Wide Web, is a major revolutionary force that is reshaping the educational and training scenario. However, one may also observe that the COMPUTER NETWORK is merely a technological device to link together human beings into collaborative CONVERSATIONAL NETWORKS, where they can exchange ideas and share materials, often stored and presented as hypertext or hypermedia INFORMANON NETWORKS. But the object of the whole exercise is ultimately to help individuals to build their own (and to enable them to help others build their own) CONCEPTUAL NETWORKS of interrelated ideas, strategies, and theories. These are the networks that are essential for the processes of critical analysis and evaluation of existing knowledge and the creative synthesis of new knowledge: the essential components of knowledge work, the key to employability and professional satisfaction in the future "networked society."

We may therefore argue that due, at least in part, to the technological networking of society in general, and the world of work in particular, the mix of essential human intellectual "survival skills" is of necessity changing. The employable adult of the future must develop the skills of thinking critically and reflectively, both using and creating new knowledge structures or networks. The known effective learning strategies for the development of such skills involve intensive interaction not only with content structured into knowledge networks, but with other people (both "masters" and other "apprentices") who have an interest in the specific knowledge domain. These interactions should have the characteristics of conversations between members of a network of people with common interests. As other impacts of technology on society lead to such effects as globalization and diversification, the members of any common interest network tend to be widely scattered. Therefore, the need emerges for cost-effective media that may enable the human network to converse and in the process (incidentally) to access relevant information sources. From these needs spring the real causes for the growing importance of technology-based communication networks, such as the World Wide Web in education. A true case of necessity being the mother of invention.

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