

COLLABORATIVE COMPUTING TECHNOLOGIES: GROUP SUPPORT SYSTEMS

LEARNING OBJECTIVES

- Understand the basic concepts of groupwork, communication, and collaboration
- Describe how computers and computer systems enhance communication and collaboration in an enterprise
- Explain the underlying principles and capabilities of collaborative computing/group support systems (GSS)
- Explain the concepts and importance of the time/place framework
- Understand the concepts of process gain, process loss, task gain, and task loss, and explain exactly how GSS introduces, increases, or decreases each of them
- Describe specifically how a GSS utilizes parallelism and anonymity, and how they lead to process/task gains/losses
- Describe how to structure an electronic meeting
- Understand the three technologies of GSS
- Understand how the Web enables collaborative computing/group support systems/electronic meetings
- Explain how GSS software enables distance learning
- Define creativity and how GSS can enhance it.

Groups make most of the complex decisions in organizations. People work together. The increase in organizational decision-making complexity increases the need for meetings and for groupwork. Supporting groupwork where team members may be in different locations and working at different times emphasizes important aspects of communications, computer technologies, and work methodologies. Group support is a critical aspect of this century's decision support systems. Effective computer-supported cooperative work (CSCW) systems have evolved to provide gains (and losses) in task performance and processes. CSCW includes group support systems (GSS), electronic meeting systems, and electronic conferencing systems. Many readers may currently use distance learning, an important form of collaborative computing. Finally, we discuss creativity and how collaborative computing can enhance it. The sections of this chapter are as follows:

- 7.1 Opening Vignette: Chrysler SCOREs with Groupware
- 7.2 Group Decision-Making, Communication, and Collaboration
- 7.3 Communication Support
- 7.4 Collaboration Support: Computer-Supported Cooperative Work
- 7.5 Group Support Systems
- 7.6 Group Support Systems Technologies
- 7.7 GroupSystems MeetingRoom and Online
- 7.8 The GSS Meeting Process
- 7.9 Distance Learning
- 7.10 Creativity and Idea Generation

7.1 OPENING VIGNETTE: CHRYSLER SCORES WITH GROUPWARE¹

THE CHRYSLER SCORE PROGRAM

Chrysler Corporation has met the challenge of reducing supply costs while improving suppliers' profitability through its supplier cost-reduction effort (SCORE) initiative. SCORE challenges suppliers in Chrysler's extended enterprise to continuously seek out and identify opportunities to reduce costs. SCORE is Chrysler's way of documenting cost reductions and quality enhancements in a variety of areas, including design, manufacturing, logistics, sourcing, and administrative transactions.

The cost-cutting program was originally paper-based. It began in 1989 when Chrysler took the unprecedented step of offering its suppliers a cut of whatever cost savings they could achieve. In 1994 Chrysler moved the program online. Three years after going online, Chrysler went from an overall net loss of \$2.6 billion to a net gain of \$3.5 billion in 1996. The SCORE program, a precursor of electronic commerce, has had a remarkable return on investment.

Chrysler pursues efficiency, quality, and affordability while enhancing its suppliers' profit margins. Chrysler works with its suppliers as partners, not adversaries, with the goal of finding ways to improve efficiency and mutually reduce costs. A supplier's incentive is significant; it can be half of the total savings. In a recent independent report, automotive suppliers ranked Chrysler number one in terms of their business relationships with them. The feeling is mutual. In 1997 Chrysler presented 13 of its suppliers with its highest honor, the Platinum Pentastar Award for outstanding overall

¹Adapted from J. L. Hartley, B. M. Greer, and S. Park, "Chrysler Leverages Its Suppliers' Improvement Suggestions." *Interfaces*, Vol. 32, No. 4, July/August 2002, pp. 20-27; D. Walker, "Supply Chain Collaboration Saves Chrysler \$2.5 Billion and Counting," *Automatic ID. News*, Vol. 14, No. 9, August 1998, p. 60; J. Fontana, "Chrysler's \$2B Score," *InternetWeek*, March 9, 1998, pp. 1,90; J. Fontana, "Chrysler Saves Big Online," *CommunicationsWeek*, April 28, 1997, pp. 1,84-85; J. T. Landry, "Supply Chain Management: The Case for Alliances," *Harvard Business Review*, Vol. 76, No. 6, November/December 1998, pp. 24-25; Konicki (2002a, 2002b); K. M. Carrillo, "Tools Address Different Ends of the Supply Chain," *InformationWeek*, No. 699, September 7, 1998, p. 26; also see Covisint, covisint.com, 2003; and Lotus Development Corporation, lotus.com, 2003.

performance. Chrysler wants to be its suppliers' best customer because the best customers always get the best service.

THE SCORE SYSTEM

In 1989 paper-based SCORE business processes were developed and deployed. The goal was to identify waste in the value chain and eliminate it. The paper-based system was moderately successful. To enhance communication and collaboration and speed up the process, Chrysler moved from a paper-based system to a groupware environment.

The business process was already in place, and by 1994 appropriate technology had evolved to support it. The first online SCORE was a single, pure Lotus Notes application database with hundreds of Notes clients. Suppliers had access to the Chrysler SCORE system via the Internet or via a modem. They used an online Notes form in which they described the cost savings. With a push of a button, this cost savings/quality improvement proposal was submitted to Chrysler. The information about a proposed savings is collected, reviewed by a buyer, and if it has merit, is sent to all team members (finance, purchasing, engineering), who then collaborate on it. About 70 percent of all suggestions have been adopted. The second-generation online system, SCORE2, supported automated procurement functions and e-mail. SCORE2 also contained user profiles, system intelligence enablers, database reports, and bilingual support. SCORE2 involved reengineering the successful business process for smoother operation.

By 1998 SCORE had become a company standard for dealing with suppliers, adding all procurement to the previous focus on goods used only in the production of automobiles. With the latest release, SCORE3, there were 1,000 suppliers online. The Web-based SCORE3 allows users to access the program through Covisint (covisint.com), an *extranet* that is a collaborative effort among the major U.S. automakers and hundreds of their suppliers. Covisint became operational in 1998, and Chrysler required its top three tiers of suppliers to connect to it by mid-1999.

SCORE BENEFITS

Chrysler's benefits are enhanced relationships with suppliers and better-quality purchasing practices, which yield a better-quality product. SCORE lets Chrysler use its suppliers' expertise to become a better company. The initiative has yielded substantial dollar savings: \$2.5 billion through 1998, including more than \$1 billion in 1997 and \$1.2 billion in 1998. The benefits to suppliers include identifying quality methods and reaping identical cost benefits from shared cost savings. The main benefit to customers is simple and obvious: a higher-quality product at an equal or lower price.

In 2000, Chrysler saved \$2 billion, and *all* of its suppliers were online.

COMMENTS

Paul Lawrence, at the Harvard Business School, and Ranjay Gulati, at Northwestern University, studied the supply relationships at two of the largest U.S. manufacturers, Chrysler and Ford. They interviewed executives and surveyed the purchasing experts for each of the major components of an automobile.

Their work indicates that to build more flexible and efficient supply chains, manufacturers need to forge close, long-term ties with their suppliers. They need to work together to refine products and components, respond to shifts in demand, and unclog bottlenecks, while sharing sensitive information. High-trust relationships can be achieved through alliances with outside suppliers—if both sides take certain steps to foster a collaborative environment.

"Manufacturers often get the best of two worlds when they form strong supplier alliances," says Gulati. "They get to work with independent, flexible companies able to specialize in a given component, and they also achieve the close integration thought to be possible only with in-house divisions." Building a high-trust alliance requires a great deal of time and effort. "For managers willing to invest in relationships," comments Lawrence, "the real choice is not the old 'make versus buy' but 'make, buy, or ally.' "

Chrysler's extended enterprise system demonstrates that managing a company's supply chain is just as important as managing its plants or distribution system. If it is done well in collaboration with its suppliers, the company gains a major strategic advantage over its competitors.

Chrysler's SCORE system has become a showcase example of the Lotus groupware platform. "It clearly is one of the best quantifications of value the industry has seen this starkly," says Jeff Papows, president and CEO at Lotus.

"Chrysler is giving us a sense of what's to come when you combine groupware, standards and interenterprise communication," comments Gary Rowe, a principal with Rapport Communication. "This is the value of having organizations invest in that type of infrastructure."

According to Tom Stalkamp, executive vice president of procurement and supply, "What we're doing is pursuing efficiency, quality and affordability without eroding our suppliers' profit margin."

"I've never had negative feedback from a supplier about SCORE. They all love it," says Bernie Bedard, manager of the supplier continuous improvement team, "It's basically a win-win, a way to work together in partnership and demonstrate that you're committed to see them grow as well as see Chrysler grow."

Four elements in Chrysler and its suppliers' organizations that clearly were observed to contribute to SCORE'S success were: (1) a process champion, (2) suppliers in the process, (3) employees, and (4) evaluation and implementation. Companies designing such a supplier-suggestion process should definitely consider ways to reduce delays during evaluation, minimize the number of low-value suggestions, and involve the entire supply chain.

• QUESTIONS FOR THE OPENING VIGNETTE

1. What prompted Chrysler to investigate development of a collaborative business process with its suppliers?
2. Explain how the supply chain works and how Chrysler uses technology to enhance communication between itself and suppliers within the supply chain construct.
3. Explain why Chrysler migrated from "a paper application to a groupware application.
4. Describe the collaboration that SCORE allows between the suppliers and the company, and within the company.
5. Describe the benefits for suppliers and for Chrysler.
6. How would you improve on SCORE?

7. Check the literature and the Web to see how SCORE has evolved since this opening vignette was written. What additional features does it have? What are the annual savings?

7.2 GROUP DECISION - MAKING , COMMUNICATION, AND COLLABORATION

The Opening Vignette illustrates how computerized support can be provided to people who work effectively in groups for the benefit of their organizations. The SCORE system involves collaboration between groups at Chrysler and their vendors and also between groups within Chrysler. Other firms are using this model successfully. For example, Johnson Controls has cut production costs by \$20 million with a collaboration portal that integrates supplier applications (see Hall, 2002). The London insurance market, through collaboration, has cut office costs by 10 percent, and paper processes by over 30 percent; Timex has cut production-development cycles by up to 40 percent (Konzer, 2002); and Lockheed Martin won a \$19 billion contract on the basis of its collaboration capabilities (Konicki, 2001). People make decisions, they design and manufacture products, they develop policies and strategies, they design software, and so on. They collaborate and communicate—people perform groupwork. Some characteristics of groupwork are listed below:

- A group performs a task, sometimes decision-making, sometimes not.
- Group members may be located in different places.
- Group members may work at different times.
- Group members may work for the same or for different organizations.
- The group can be permanent or temporary.
- The group can be at any managerial level or can span levels.
- There can be synergy (process and task gains) or conflict in groupwork.
- There can be gains and/or losses in productivity from groupwork.
- The task may have to be accomplished very quickly.
- It may be impossible or too expensive for all the team members to meet in one place.
- Some of the needed data, information, or knowledge may be located in many sources, several of which are external to the organization.
- The expertise of non-team members may be needed.

When people work in teams, especially when the members are in different locations and may be working at different times, they need to communicate, collaborate, and access a diverse set of information sources in multiple formats.

For groups to collaborate effectively, appropriate communication methods and technologies are needed. The Internet and its derivatives, intranets and extranets, are the platforms on which most communications for collaboration occur. The Internet (World Wide Web or Web), a network of computer networks, supports interorganizational decision-making through collaboration tools and access to data, information, and knowledge from inside and outside the organization. Intraorganizational networked decision support can be effectively supported by an intranet, basically an inter-

nal Internet. People within an organization can work with Internet tools and procedures through enterprise information portals. Specific applications can include important internal documents and procedures, corporate address lists, e-mail, tool access, and software distribution. An intranet operates safely behind a company's firewall, which typically isolates it from inappropriate external access. A good example of an intranet application is the Osram Sylvania HR InfoNet (a portal) described in the Chapter 6 Opening Vignette. An extranet links a work group, functioning like an intranet for group members from several different organizations. Several automobile manufacturers have involved their suppliers and dealers in extranets to help them deal with customer complaints about their products. Other extranets are used to link teams together to design products, where several different suppliers must collaborate on design and manufacturing techniques. And extranets like the Covisint are used by entire industries to link companies and suppliers (see the Opening Vignette; Kemp, 2001).

There have been many advances in Web-based collaborative design, as is described in the opening vignette. New tools are continually under development (see Anthes, 2000). Autodesk's Architectural Studio and CoCreate's OneSpace allow several designers to work simultaneously. Most major auto manufacturers are moving in this direction because it substantially reduces the cost and time of bringing new models to market (see Konicki, 2002b, Gladwin, 2001). This market should be worth well over \$100 billion by 2007 (see Konicki, 2002a, 2000b). For details on how GSS can enhance systems analysis and design, see Lowry and Wilson (2000), and Maybury (2001).

Even in hierarchical organizations, decision-making is usually a shared process. A group may be involved in a decision or in a decision-related task, such as creating a short list of acceptable alternatives or choosing criteria for evaluating an alternative. The following activities and processes characterize meetings:

- A meeting is a joint activity engaged in by a group of people typically of equal or near-equal status.
- The outcome of the meeting depends partly on the knowledge, opinions, and judgments of its participants.
- The outcome of the meeting also depends on the composition of the group and on the decision-making process used by the group.
- Differences in opinion are settled either by the ranking person present or, more often, by negotiation or arbitration.

Many computerized tools have been developed to provide group support. These tools are called groupware because their primary objective is to support groupwork. The work itself may be known as computer-supported cooperative work (CSCW). (The literature uses the word *cooperative*, and we adhere to it, though *collaborative* might be a more accurate term. For example, consider two or more groups involved in negotiations.) Groupware tools can be readily found via a Web search. Some notable ones include GroupSystems OnLine and MeetingRoom, Groove, NetMeeting, WebEx, and Place Ware. Some e-mail, chatroom, and instant messenger software exhibit groupware features.

Telecommuting, teleconferencing, supply chain management, and electronic commerce are *all* enabled through communication and collaboration technologies. It is almost impossible to be away from the office (home, dormitory, etc.) and not be connected. Distance learning is a fast-developing area of collaborative computing. And groupware can enhance creativity in the decision-making process.

Groups and groupwork (teams and teamwork) in organizations are proliferating. Consequently, groupware continues to evolve to support effective groupwork. For examples of effective groupware use in industry, see McGee and Murphy (2001), who describe the leading innovators in collaboration.

7.3 COMMUNICATION SUPPORT

Communication is a vital element for decision support. *Without communication, there is no collaboration.* Individual decision-makers must communicate with colleagues, experts, government agencies, customers, vendors, business partners, and other interested parties. They also need data and information (and *knowledge*) from many locations around the globe. Groups of decision-makers must communicate, collaborate, and negotiate in their work. Most organizations would quickly become nonfunctional without their communication systems. Virtual teams, especially those performing design work, require fast communication technology for success in their efforts (see Chapter 6). Effective e-commerce is possible only via modern Web-based communication technologies.

Modern information technologies, especially via the Web, provide *inexpensive, fast, capable, reliable* means of supporting communications. (See DSS in Focus 7.1 for some unsupported aspects of communication.) Networked computer systems, like the Internet, intranets, and extranets, are the enabling platforms that support communication. Historically, these systems began with the telegraph, the telephone, radio, and television. Technologies that followed built upon them. Within about 100 years, we have developed fax machines, electronic mail (e-mail), chat programs, newsgroups, listservs (electronic mailing lists), electronic bulletin boards, and inexpensive, effective desktop videoconferencing systems (see DSS in Action 7.2, and Donston (2002) for effective uses and the benefits of videoconferencing). The use of desktop videoconferencing systems has grown dramatically in the wake of the events of September 11, 2001 (see Cope, 2002; Goodridge, 2001b). Even three-dimensional television systems have entered the market (Connolly, 2001). Most of these technologies operate on the Web/Internet. Because they are so widely used in modern enterprises and even at home, we will not discuss the details here. We next turn to collaborative technologies that include the latest communication developments of electronic meeting systems (EMS) and electronic conferencing systems and services, generally using the Internet for connecting decision-makers.

As Davids (1999) comments in reference to videoconferencing, the following advantages apply to all improved communications methods in organizations: (1) improving employee productivity, (2) involving more people in key decision-making, (3) blurring geographic boundaries, (4) creating a consistent corporate culture, and (5) improving employees' quality of life.

Communication may be considered a social matter in which negotiating differences in understanding among and between communicators is a primary business priority. It is important to understand how individuals interact in the decision-making process. Smoliar and Sprague (2002) consider communication along three dimensions—meaning, authority, and trust—based on the work of Anthony Giddens. These notions may soon open up a rich understanding of how we communicate when working together.

DSS IN FOCUS 7.1

COMMUNICATION PROBLEMS

Communication can be problematic in general, but computerized communication methods do not transmit most of our nonverbal cues, which are important in establishing the richer meaning of a message by adding context. A large part of what we mean (perhaps exceeding 50 percent) is conveyed via nonverbal cues. Facial expressions, body language, voice tone, expression, inflection, touching, and distance are but a few. (For example, it is possible to accurately determine who will win a U.S. presidential election by measuring the average rate of each candidate's eye blinking. The one who blinks the least has won every election from the Kennedy-Nixon contest in 1960 through 2000. Jay Aronson used this method in the third debate of the 2000 election to predict the winner accurately.) There are cross-cultural aspects and language subtleties that are not easily transmitted through computer-mediated communication channels.

Emoticons were a first attempt to include nonverbal cues in text-based e-mail. For example, in the emoti-

con system, the characters :) are a happy face called a "smiley," and writing your message in all capital letters means you are SHOUTING! These have been updated into icons in instant messenger software.

Some aspects of communication, such as the frequency of touching and the interpersonal distance between participants, are difficult to capture through technology. However, video technology can show facial expressions and some body language. Researchers are attempting to develop collaborative systems that capture more of this imprecise nature of human communication that makes the meaning of the message received more precise. They are also developing output devices, like robot faces that can reflect mood, to do the same (e.g., see Dan Ferber, "The Man Who Mistook His Girlfriend for a Robot," *Popular Science*, September 2003; available at www.popsci.com/popsci/archives, search on "face").

DSS IN ACTION 7.2

VIDEOCONFERENCING IS READY FOR PRIME TIME

Videoconferencing technology can cut travel expenses and increase a company's productivity. Dan Denardo, manager of global videoconferencing at Dow Chemical Company (an \$18 billion per year firm), says that videoconferencing vastly improves customer service and helps Dow deliver products to the market faster. "We know it can decrease cycle time, since we can hold more meetings in the same amount of time," Denardo says. Dow has about 160 video cameras at its headquarters in Midland, Michigan, and has achieved an estimated annual travel cost savings of more than \$7 million. At Dow, the technology is advancing from in-house conference rooms to customer sites. "It is fairly cheap hardware, the customers really like it and it sets us apart," Denardo comments. By July 1999, Dow had linked six customers.

Quantum Corporation (a \$4.9 billion per year storage vendor) saves about \$500,000 per month in travel expenses, lost time, and productivity, according to Albert Villarde, a network analyst. Quantum has over 20 video-equipped conference rooms around the globe.

The primary business advantage is the speed-up in information sharing.

Estimates vary, but Pat Conway, product marketing manager at videoconferencing vendor VTEL Corporation, estimates that videoconferencing should reduce a firm's travel budget by about 15 percent. The most significant savings come from the increased speed of information delivery because of more frequent, impromptu meetings.

Technology varies from PC desktop video to stand-alone conference rooms. Most companies use DSL or cable television Internet connections, or ISDN lines because of the higher bandwidth. Videoconferencing is an economical way to cut travel costs and boost productivity. Since September 11, 2001, these technologies have become critical, because air travel is not as convenient as previously.

Source: Partly adapted from L. Wood, "Videoconferencing Shows It's Ready for Prime Time," *InternetWeek*, July 12, 1999, p. 26.

7.4 COLLABORATION SUPPORT :
COMPUTER - SUPPORTED COOPERATIVE WORK

In modern organizations, people collaborate. Groups make most major decisions in organizations. Solving complex problems requires that people work together, necessitating the formation of workgroups.

Communication primarily transmits information from a sender to a receiver, but collaboration is much deeper. Collaboration conveys meaning or knowledge among group members. Material is actively worked on during collaboration. Collaboration includes sharing documents, information, and knowledge, as well as such activities as brainstorming and voting. Collaboration implies people actively *working together* and requires collaborative computing support tools that build on communication methods. Computer-supported cooperative work (CSCW) systems are known as group support systems (GSS) or groupware. They include electronic meeting systems and electronic conferencing systems.

TIME/PLACE FRAMEWORK

The effectiveness of a collaborative computing technology depends on the location of the group members and on the time that shared information is sent and received. A framework for classifying IT communication support technologies was proposed by DeSanctis and Gallupe (1985,1987). Communication is divided into four cells, which are shown together with representative computerized support technologies in Figure 7.1. The four cells are organized along the two dimensions of *time* and *place*.

FIGURE 7.1 TIME/PLACE COMMUNICATION FRAMEWORK AND SOME COLLABORATIVE COMPUTING SUPPORT TECHNOLOGIES

	Same time jwwwwwwwas	Different time
Same place	<ul style="list-style-type: none"> » GSS in a decision room > Web-based GSS » Multimedia presentation systems « Whiteboard » Document sharing 	<ul style="list-style-type: none"> • GSS in a decision room • Web-based GSS • Workflow management system • Document sharing • E-mail, V-mail • Video conferencing playback
Different place jwwewww	<ul style="list-style-type: none"> • Web-based GSS ¹ Whiteboard • Document sharing ¹ Video conferencing ¹ Audio conferencing ¹ Computer conferencing ¹ E-mail, V-mail 	<ul style="list-style-type: none"> > Web-based GSS > Whiteboard > Document sharing > E-mail, V-mail « Workflow management system » Computer conferencing with memory • Video conferencing playback

- *Time.* When information is sent and received almost simultaneously, the communication is synchronous. Telephones, televisions, and face-to-face meetings are examples. Asynchronous communication occurs when the receiver receives the information at a different time than it was sent.
- *Place.* The senders and the receivers can be in the same room or not.

The four cells of the framework are as follows:

- *Same time/same place.* Participants meet face-to-face in one place at the same time, as in a traditional meeting or decision room. This is still an important way to meet, even when Web-based, because it is sometimes critical for participants to leave the office to eliminate distractions (if so, turn off your cell telephone ringer).
- *Same time/different place.* Participants are in different places, but they communicate at the same time, for example, with videoconferencing.
- *Same time/different place.* People work in shifts. One shift leaves information for the next shift.
- *Same time/different place.* Participants are in different places. They send and receive information at different times. This occurs when team members are traveling, have conflicting schedules, or work in different time zones. Meetings such as these require some special handling. For example, when brainstorming, it is important not to barrage group members who enter the meeting later with all the ideas that have been generated. That makes them feel excluded. The previously generated ideas should be fed slowly to them.

GROUPWARE

The term *groupware* refers to software products that provide collaborative support to groups. Groupware provides a mechanism for teams to share opinions, data, information, knowledge, and other resources. Different collaborative computing technologies support groupwork in different ways, depending on the time/place category in which the work occurs, the purpose of the group, and the task. New tools are evolving to support *anytime/anyplace* meetings.

There are thousands of packages that contain some elements of groupware. Some have only rudimentary collaboration capabilities (e.g., voting; see DSS in Action 7.3), whereas others provide support for every aspect of collaboration (full electronic meetings with videoconferencing). Almost all utilize Internet technology for the consistent Web browser-style user interface and communication protocols.

Groupware typically contains capabilities for at least one of the following: electronic brainstorming, electronic conferencing or meeting, group scheduling, calendaring, planning, conflict resolution, model building, videoconferencing, electronic document sharing (e.g., screen sharing, whiteboards, or liveboards), voting, organizational memory. There are electronic meeting services like WebEx Meeting Center (webex.com), Place Ware Conference Center (placeware.com), and MCI Conferencing (e-meetings.mci.com), where anyone can hold a meeting for a fee. Some groupware, such as Lotus Notes/Domino (lotus.com), Microsoft NetMeeting (microsoft.com), Groove (groove.net), and GroupSystems OnLine (groupsystems.com), support a fairly comprehensive range of activities. Each vendor provides success stories about its GSS product or service, as well as demos, trial versions, or video presentations on its Web site. We next briefly describe some popular groupware systems.

LOTUS NOTES/DOMINO

Lotus Notes/Domino was the first widely used groupware. Lotus Notes/Domino enables collaboration by letting users access and create shared information through

DSS IN ACTION 7.3

INTERNET VOTING

Collaborative technologies that include voting mechanisms operating over the Internet have enhanced groupwork. Voting for public office may be the ultimate form of groupware use. A hot topic in the United States in early 2000 was whether or when states will permit public elections over the Internet. Texas was the first state to permit voting over the Internet, but it was tightly regulated. The resident had to be in orbit in the space shuttle. In 2000 Alaska permitted straw polling via the Internet for residents living in isolated regions. Straw polling is a formal part of the Alaska presidential primary process. The state of Washington allowed any registered voter to use the Internet in the 2000 presidential primary. California and Arizona also tested

Internet voting. There are problems with anonymity and with voter validation, but they seem to be no worse than paper-based polling practices (such as those known to have occurred in Chicago some years ago). Internet voting can cut costs on mailing and processing paper ballots, as well as reduce human error in counting. After the problems of the 2000 U.S. presidential election, several states adopted electronic voting machines which effectively utilize Web-based technology at polling places. Georgia deployed them in the next state and local election, and eventually will move to Web polling. In 2000, several states were investigating how to establish accurate Web-based polling. For more on online voting, see Harrison (2000) and Tillett (2000).

especially programmed Notes documents. For example, Chrysler's SCORE system in the Opening Vignette and the Osram Sylvania HR InfoNet enterprise portal in the Chapter 6 Opening Vignette were programmed in Lotus Notes/Domino. Notes provides online collaboration capabilities through Web Conferencing on Demand, workgroup e-mail, distributed databases, bulletin whiteboards, text editing, (electronic) document management, workflow capabilities, consensus building, voting, ranking, and various application development tools, all integrated into one environment with a graphical menu-based user interface. Notes fosters a virtual corporation and creates interorganizational alliances. Though increased competition is cutting into its market share, there are millions of Notes users in thousands of organizations. Many applications have been programmed directly in Lotus Notes. This includes Learning Space, a courseware package that supports distance learning.

MICROSOFT NETMEETING

Microsoft NetMeeting is a real-time collaboration package that includes whiteboarding (relatively free-form graphics to which all participants can contribute simultaneously), application sharing (any Microsoft Windows application document), remote desktop sharing, file transfer, text chat, data conferencing, and desktop audio- and videoconferencing. This application sharing is a vast improvement over what was simply called *whiteboarding* a decade ago. The NetMeeting client is included in the Windows operating system. See DSS in Action 7.4 for an example of the successful use of NetMeeting. Also see the NetMeeting in Action stories at microsoft.com.

GROOVE

Groove Workspace is the Groove end-user application for secure discussions, file-sharing, projects, and meetings. Used alone or with Groove Enterprise Servers and Hosted Services, Groove Workspace enables spontaneous, online-offline collaboration that reduces project costs and speeds time-to-market for products and services. The Groove Outliner tool is an open-ended brainstorming tool that allows shared space members to build structured hierarchical lists. The Groove peer-collaboration platform works

NETMEETING PROVIDES A REAL-TIME ADVANTAGE

Jack O'Donnell is CEO of O'Donnell & Partners, a corporate interior contracting firm in Manhattan with branch offices in Chicago, London, and Milan. Until recently, O'Donnell felt the need to be on-site when any project was in its crucial stages. "Phone calls weren't enough, nor was e-mail—especially when you're dealing with a team of architects, designers, and contractors who speak different languages and all have their own professional jargon," he says. "Add to that the need for working on plans, sketches, and blueprints together at meetings, and my partners and I found we were spending most of our time at airports."

Microsoft NetMeeting provides collaborative computing support for groupwork, including application sharing through its Remote Desktop Sharing feature. It also provides real-time video. Now O'Donnell and his

team members meet online. "Everyone can prepare a presentation that shows and doesn't just tell the progress of their part of the project," says O'Donnell. "We can work on files together, as if we were sitting across from each other at a conference table. And we can see each other's expressions, so it feels more like a real meeting." (See DSS in Focus 7.2.)

O'Donnell estimates that Web conferencing saved his company at least a half-million dollars in travel costs in 1999. And that did not include the benefit of having fewer people out sick with whatever virus they picked up on their last plane trip.

Source: Adapted from M. Delio, "Power Meetings in Cyberspace," *Knowledge Management*, Vol. 2, No. 12, Dec. 1999, pp. 77-78.

across corporate firewalls and requires no special configuration or IT administration (see groove.net). A very functional demo version is available for download (no video-conferencing). Though it takes a while to structure a first meeting and download all files to users, it is definitely an inexpensive, useful, peer-to-peer package. A screenshot of a Groove Outliner session is shown in Figure 7.2.

GROUPSYSTEMS MEETINGROOM AND ONLINE

GroupSystems MeetingRoom and OnLine (groupsystems.com) was one of the first comprehensive same time/same place electronic meeting packages and set the pace for the industry. GroupSystems OnLine (originally called Groupsystems) runs in asynchronous mode (anytime/anyplace) over the Web, while MeetingRoom runs over a local area network. GroupSystems OnLine was a response to the needs of the marketplace, and was used in many academic studies to establish needed tools and how they should operate. These packages set the pace for the rest of the marketplace; their capabilities are described in a later section.

WEBEX MEETING CENTER AND PLACEWARE CONFERENCE CENTER

WebEx Meeting Center (WebEx.com) is pay-per-use groupware. It provides a low-cost, simplified way to hold electronic meetings over the Web. Meeting time and space are rented and accessed over the Web. WebEx contains all the features you need to run a meeting. WebEx Meeting Center integrates data, voice, and video within a standard Web browser for real-time meetings over the Internet from any desktop, laptop, or wireless handheld device. WebEx contains all the tools needed to share documents or opinions. WebEx Meeting Center is a fully hosted solution, initiating online meetings that require no IT staff involvement, and has very low start-up costs. The WebEx

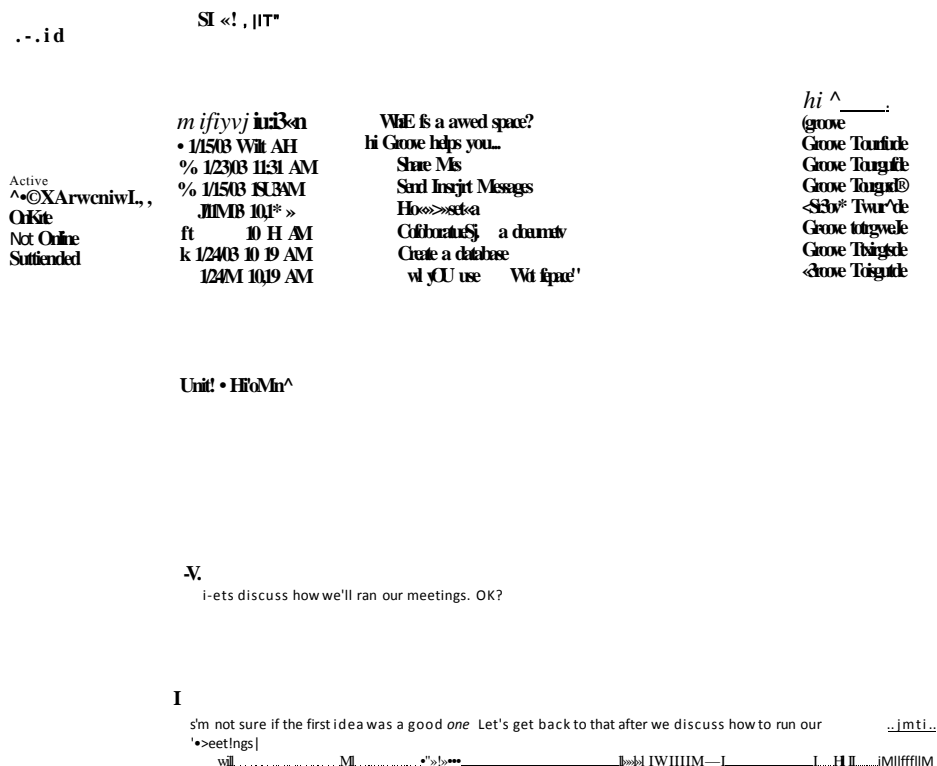


FIGURE 7.2 EXAMPLE of EIKTRONK BRAINSTORMING IN THE GHOOVF WORKSPACE

The participant types his/her ideas in the small box at the bottom. Then, he/she clicks the send button. The idea is then added to the threaded discussion and appears above the box.

MediaTone Network provides fast communication for videoconferencing. The **PlaceWare Conference Center** (placeware.com) provides essentially the same services, along with the **PlaceWare Virtual Classroom**, a distance learning environment.

REMARKS

Successful enterprise-wide collaboration systems like Lotus Notes/Domino can be expensive to develop and operate. To obtain the full benefits of such groupware, a well-traiijed, full-time support staff is required to develop applications and operate the system. On the other hand, Groove is relatively cheap and provides easy to use and set up collaboration for an organization.

Industry reports estimate that all forms of groupware (audio-conferencing, videoconferencing, data conferencing, Web-based conferencing, etc.) have become a more established part of the corporate decision-making process. In 2001, the total collaboration market totaled \$4.4 billion, up 20 percent over the previous year. By 2005, spending should reach about \$8.8 billion. This growth is driven by time and money savings through less travel, and by organizational decentralization and globalization. See Anonymous (2002d).

7 7 5 G R O U P S U P P O R T S Y S T E M S

Most groupwork takes place in meetings. Despite the many criticisms of the effectiveness and efficiency of meetings, people still get together in groups to discuss issues and to work. Meetings can be effective despite the fact that up to 80 percent of what is discussed in a meeting is either forgotten or remembered incorrectly.² See DSS in Focus 7.5 for a description of what does and does not work in meetings. 3M Corporation's 3M Meeting Network (www.3m.com/meetingnetwork/) and technography.com have information, surveys, and tips about how to run more effective meetings. The goal of groupware, as it was specifically developed as group support systems (GSS), is to support the work of groups throughout every work activity—including meetings.

Despite the inefficiency of meetings, groupwork can and does provide some benefits, and some dysfunctions. In DSS in Focus 7.6, we identify a set of potential benefits, or process gains, of collaborative work. Even so, collaborative work can often be plagued with dysfunctions called process losses (see DSS in Focus 7.7).

The goal of GSS is to increase some of the benefits of collaboration and eliminate or reduce some of the losses. Researchers have developed methods for improving the *processes* of groupwork, and some of these methods are group dynamics. Two representative methods are the nominal group technique (NGT) and the Delphi method. These methods are manual approaches to supporting groupwork. See Lindstone and Turroff (1975) and the Web Chapter on these topics for details.

The limited success of such methods as NGT and the Delphi method led to attempts to use information technology to support group meetings. The major technology is called a group support system (GSS). At the start of the 1990s, this term was coined to replace *group decision support system* (GDSS) because researchers recognized that collaborative computing technologies were doing more than supporting decision-making.

A group support system (GSS) is any combination of hardware and software that enhances groupwork. GSS is a generic term that includes all forms of collaborative computing. GSS evolved after information technology researchers recognized that technology could be developed to support the many activities normally occurring at face-to-face meetings (idea generation, consensus building, anonymous ranking, voting, etc.).

A complete GSS is still considered a specially designed information system, but since the mid-1990s many of the special capabilities of GSS have been embedded in productivity tools. For example, Microsoft NetMeeting Client is part of Windows. Most GSS are easy to use because they have a Windows GUI or a Web browser interface. Most GSS are fairly general and provide support for activities like idea generation, conflict resolution, and voting.

An electronic meeting system (EMS) is a form of groupware that supports anytime/anyplace meetings. Group tasks include, but are not limited to, communication, planning, idea generation, problem-solving, issue discussion, negotiation, conflict resolution, system analysis and design, and collaborative group activities such as document preparation and sharing (Dennis et al., 1988, p. 593). Typically EMS include desktop videoconferencing, whereas in the past GSS did not. However, there is a blurring between these two concepts, so today they should be considered synonymous.

GSS settings range from a group meeting at a single location for solving a specific problem (e.g., building design; see DSS in Action 7.4) to multiple locations held via

²This makes one wonder about the effectiveness of the traditional classroom setting.

DSS IN FOCUS 7.5

J

THE SEVEN SINS OF DEADLY MEETINGS AND SEVEN STEPS TO SALVATION

Since meetings can be ineffective, unproductive, and unending (to say the least), it helps to understand what can go wrong and what can go right. Bad meetings can be a source of negative messages about an organization and its members. Because more work is becoming groupwork, the number of meetings will likely increase. There are a variety of tools and techniques that, along with common sense, can make meetings less painful, more productive, and maybe even fun. The following is a summary of the "seven sins" of deadly meetings and seven approaches to making meetings more productive.

Sin 1: People don't take meetings seriously. They arrive late, leave early, and spend most of their time doodling. **Salvation:** Adopt a mind-set that meetings are real work. Disciplined meetings are about mind-set—a shared conviction among all the participants that meetings are real work.

Sin 2: Meetings are too long. They should accomplish twice as much in half the time.

Salvation: Time is money. Track the cost of meetings and use computer-enabled simultaneity to make them more productive. Meetings should last no longer than 90 minutes. Often people don't appreciate how expensive meetings really are. Bernard DeKoven (Technography.com, Katy, Texas) developed the Meeting Meter. It is a taxi-like meter that tallies the meeting's total cost (excluding travel time and illness; a Web search will identify several that run directly on the Web). One quick look at the numbers, and it's back to work, quickly. Groupware can provide parallelism, especially in brainstorming, cutting meeting time down.

Sin 3: People wander off the topic. Participants spend more time digressing than discussing.

Salvation: Get serious about agendas and store distractions in a "parking lot." Make sure you have an agenda. This involves *planning the meeting*.

Sin 4: Nothing happens once the meeting ends. People don't convert decisions to action.

Salvation: Convert from "meeting" to "doing," and focus on common documents. When people leave meetings, they may or may not remember what happened or what is supposed to happen next. The capacity for misunderstanding is unlimited. Group memory is needed. Shared documents must be created. This is the most powerful role for technology: people should leave with real-time minutes.

Sin 5: People don't tell the truth. There's plenty of conversation but not much candor.

Salvation: Embrace anonymity. People may not feel secure enough to say what they really think. GSS that provide anonymity can help.

Sin 6: Meetings are always missing important information, and so they postpone critical decisions.

Salvation: Get data, not just furniture, into meeting rooms. Again, GSS can help in providing a means for capturing and maintaining data.

Sin 7: Meetings never get better. People make the same mistakes over and over again.

Salvation: Practice makes perfect. Monitor what works and what doesn't, and hold people accountable. At Charles Schwab & Company, someone serves as an "observer" and creates a Plus/Delta list for virtually every meeting. This list records what went right and what went wrong, and it becomes part of the minutes. Over time, both for specific meeting groups and for the company as a whole, these lists create an agenda for change. These lists form an *organizational memory*.

How much can meetings improve? Bernard DeKoven says, "People don't have good meetings because they don't know what good meetings are like. Good meetings aren't just about work. They're about fun—keeping people charged up. It's more than collaboration, it's 'coliberation'—people freeing each other up to think more creatively."

Source: Adapted from E. Matson, "The Seven Sins of Deadly Meetings," *Fast Company*, No. 2, April 1996, p. 122.

telecommunication channels for the purpose of considering a variety of problems (e.g., a class over distance learning; see the WELCOM Web Chapter, and the situation faced by rocket engine designers at Boeing-Rocketdyne, described by Malhotra et al. (2001). Also see Burke (2002). Using effective new collaboration methods that continue to evolve, GSS can operate in asynchronous mode (different times).

DSS IN FOCUS 7.6

SOME BENEFITS OF GROUPWORK (PROCESS GAINS)

It provides *learning*. Groups are better than individuals at understanding problems.

People readily take ownership of problems and their solutions. They take responsibility.

Group members have their egos embedded in the decision, and so they will be committed to the solution.

Groups are better than individuals at catching errors.

A group has more *information* (knowledge) than any one member. Groups can combine this knowledge to create new knowledge. More and more cre-

ative alternatives for problem-solving can be generated, and better solutions can be derived (through *stimulation*).

A group may produce *synergy* during problem-solving.

Working in a group may stimulate the creativity of the participants and the process.

A group may have better and more precise communication working together.

Risk propensity is balanced. Groups moderate high-risk takers and encourage conservatives.

GSS can be considered in terms of the common group activities that can benefit from computer-based support: *information retrieval*, including access of data values from an existing database and retrieval of information from other group members; *information sharing*, the display of data for the whole group on a common screen or at group members' workstations for viewing; and *information use*, the application of software technology (e.g., modeling packages or specific application programs; see DSS in Focus 7.8; Andrienko et al., 2002; Dias and Climaco, 2002), procedures, and group problem-solving techniques for reaching a group decision. Creativity in problem-solving can be enhanced via GSS (discussed later in this chapter).

The goal of GSS is to provide support to meeting participants to improve the productivity and effectiveness of meetings by speeding up the decision-making process (efficiency) or by improving the quality of the results (effectiveness). GSS attempts to increase process and task gains and decrease process and task losses (see Reinig and Shin, 2002). Specific GSS process gains are listed in DSS in Focus 7.9. Overall, GSS has been successful in practice (see Holt, 2002); however, some process and task gains may decrease, while some process and task losses may increase.

Improvement is achieved by providing support to group members for the exchange of ideas, opinions, and preferences. Specific features such as parallelism and anonymity produce this improvement. Many experiments, field studies, and surveys have been done to determine the effectiveness of GSS (e.g., Fjermestad, 2000/2001; Fjermestad and Hiltz, 1998; Dennis, Wixom, and Vandenberg, 2001). After a few decades of GSS experience, it is clear that GSS is a winner. Saved travel time (especially when using the Web) and parallelism have led to decreased costs, while anonymity leads to the generation of more ideas and more creative ideas. For examples, see Case Application 7.1, the WELCOM Web Chapter, DSS in Action 7.10, and the success stories on GSS vendor Web sites, where collaborative computing led to dramatic speed-ups in process and cost savings.

DSS IN FOCUS 7.7

**POTENTIAL DYSFUNCTIONS OF GROUPWORK
(PROCESS LOSSES)**

Social pressures of conformity may result in group-think (people begin to think alike and not tolerate new ideas—yielding to *conformance pressure*).

It is a time-consuming, slow process (only one member can speak at a time).

Lack of coordination of the meeting work and poor meeting planning.

Inappropriate influences (domination of time, topic, opinion by one or few individuals; *fear of contributing* because of the possibility of *flaming*, and so on).

Tendency of group members to rely on others to do most of the work (free-riding).

Tendency to produce compromised solutions of poor quality.

Nonproductive time (socializing, preparing, waiting for late-comers—*air-time fragmentation*).

Tendency to repeat what was already said (because of failure to remember or process).

High cost of meeting (travel, participation, etc.).

Tendency of groups to make riskier decisions than they should.

Incomplete or inappropriate use of information.

Too much information (*information overload*).

Few information cues.

Incomplete or incorrect task analysis.

Inappropriate or incomplete representation in the group.

Attention blocking.

Attenuation blocking.

Concentration blocking.

Slow feedback.

' 4 DSS IN FOCUS 7.8

**MODELS IN GROUP DECISION-MAKING-EC 2000
2ND EDITION FOR GROUPS**

Based on the Analytic Hierarchy Process (AHP) decision-making methodology implemented as Expert Choice (Chapter 4), EC 2000 2nd Edition for Groups helps group members define objectives, goals, criteria, and alternatives and then organize them into a hierarchical structure. Using PCs, participants compare and prioritize the relative importance of the decision variables. EC 2000 for Groups then synthesizes the group's judgments to arrive at a conclusion and allows individuals to examine how changing the weighting of their criteria affects the outcome.

EC 2000 for groups imitates the way people naturally make decisions: gathering information, structuring the decision, weighing the variables and alternatives, and reaching a conclusion (Chapters 2 and 4). It supports the decision process. The group structures an AHP decision hierarchy for the problem as members perceive it; members provide the judgments, and members make the decision.

Source: Partly adapted from Expert Choice Inc., Pittsburgh, PA, expertchoice.com, May 2003. Used by permission.

DSS IN FOCUS 7.9

GSS PROCESS GAINS

Supports parallel processing of information and idea generation.

Enables the participation of larger groups with more complete information, knowledge, and skills. Permits the group to use structured or unstructured techniques and methods.

Offers rapid, easy access to external information.

Allows parallel computer discussions.

Helps participants frame the big picture.

Anonymity allows shy people to contribute to the meeting (*get up and do what needs to be done*).

Anonymity helps prevent aggressive individuals from driving the meeting.

Provides for multiple ways to participate in instant, anonymous voting.

Provides structure for the planning process to keep the group on track.

Enables several users to interact simultaneously (conferencing).

Records all information presented at the meeting (organizational memory).

DSS IN ACTION 7.10

EASTMAN CHEMICAL BOOSTS CREATIVE PROCESSES AND SAVES \$500,000 WITH GROUPWARE

THE PROBLEM

Eastman Chemical wanted to use creative problem-solving sessions to process ideas. Customers would present any number of problems, and they would use flip charts and Post-it notes to come up with better solutions. But organizing and studying the notes took far too long. The company needed more ideas and better methods to meet customers' needs. Traditional methods were not effective. The process was extremely unproductive and time-consuming.

THE SOLUTION

Eastman Chemical chose GroupSystems to support its problem-solving and dramatically improved its meetings. Here's how the meetings work now. First, participants define the problem and frame it. Then participants brainstorm ideas to develop potential solutions to the problem, trying for "outside-the-box" thinking using creativity techniques. Recently, some 400 ideas were generated by nine people in a two-hour session (through parallelism). After categorizing similar items, the team establishes common decision criteria to pick

the top three ideas using the Alternative Analysis tool. Results are then copied into an Excel spreadsheet to develop an action plan.

In addition, Eastman ran 100 R&D managers through sessions to determine top strategies. They defined eight opportunities, with an action plan to establish the top three—after generating 2,200 ideas!

THE RESULTS

Henry Gonzales, manager of the polymer technology core competency group at Eastman, states, "We found that with GroupSystems, we had more unusual ideas, a richer pool to choose from, and we got to the point a lot faster. I did a study and calculated that the software saved 50 percent of people's time, and projected a cost savings of over \$500,000 for the 12 people during a year's time." Consequently, Eastman Chemical bought a second license and upgraded to another facility so that more people could use the groupware.

Source: Adapted from "GroupSystems Case Studies," GroupSystems.com, groupsystems.com, June 2003.

7.6 GROUP SUPPORT SYSTEMS TECHNOLOGIES

There are three options for deploying GSS technology: (1) in a special-purpose decision room, (2) at a multiple-use facility, and (3) as Web-based groupware with clients running wherever the group members are.

The earliest GSS were installed in expensive, customized, special-purpose decision rooms (electronic meeting rooms) with PCs with sunken displays hidden under desks and a large public screen at the front of the room. The original idea was that only executives and high-level managers would use the facility. The software in a special-purpose electronic meeting room usually runs over a local area network (LAN), and these rooms are fairly plush in their furnishings. Electronic meeting rooms can be constructed in different shapes and sizes. A common design includes a room equipped with 12-30 networked personal computers, usually recessed into the desktop (for better participant viewing). A server PC is attached to a large-screen projection system and connected to the network to display the work at individual workstations and aggregated information from the facilitator's workstation. Adjacent to the decision room there sometimes are break-out rooms equipped with PCs connected to the server where small subgroups can consult. The output from the subgroups can also be displayed on the large public screen.

Organizations still use electronic decision rooms, and these rooms very ably support same time/same place meetings (at many universities, companies, and government agencies). One Ohio school district even built a portable facility in a bus (the driver's seat turns around to become the facilitator's seat). There is still a need and a desire for groups to meet face to face even when supported by collaborative technology. A facility like this can conveniently provide videoconferencing and distance education, and may even function as a fairly expensive computer lab.

A second option is to construct a multiple-use facility, sometimes a general-purpose computer lab or computer classroom. That also is a less elegant but equally useful GSS room. For example, at the Terry College of Business of The University of Georgia, Sanford Hall has a 48-seat lab/computer classroom with GroupSystems MeetingRoom installed. This room also "triples" as a distance learning classroom because it contains the latest academic videoconferencing software and hardware. Since a decision room might not be used 100 percent of the time for groupwork, this is an effective way to lower or share costs.

For the first and second options, a trained facilitator is necessary to coordinate the meetings. The group leader works with the facilitator to structure the meeting. The success of a GSS session depends largely on the quality, activities, and support of the facilitator (Miranda and Bostrom, 1997). For details on facilitator support, an important but often neglected aspect of GSS, see Ngwenyama et al. (1996).

Since the late 1990s, the most common approach has been the third option: using Web-based or LAN-based groupware that allows group members to work from any location at any time (e.g., Lotus Notes, Groove, WebEx, PlaceWare, GroupSystems, NetMeeting). This groupware often includes audioconferencing and videoconferencing. The availability of relatively inexpensive groupware (for purchase or for rent) combined with the power and low cost of capable PCs makes this type of system viable. Some groupware, notably Groove, runs in a peer-to-peer mode, where each person works on a copy of the entire conference so that only differences among the files need be transmitted. Thus standard telephone connections work relatively well (without video or audio modes). Also, the high cost of constructing a facility and finding an experienced facilitator, and the need to have participants connect from other locations

TABLE 7.1 Collaborative Computing/GSS and Web Impacts

<i>Collaborative Computing/GSS</i>	<i>Web Impacts</i>	<i>Impacts on the Web</i>
Collaboration	Consistent, friendly, graphical user interface for client units Convenient, fast access to team members Improved collaboration tools Access to data/information/knowledge on servers Enables document sharing Enables anywhere/anytime collaboration Enables collaboration between companies, customers and vendors	Improvements in management, hardware, software, and infrastructure due mainly to collaboration in (Web-based) CASE and other systems analysis and design tools Improvements in site design and development methods Simultaneous Web surfing (e.g., Groove)
Communication	Improved, fast communication among group members and links to data/information/knowledge sources Makes audio and video conferencing a reality, especially for individuals not using a LAN	Same as above*
Decision Rooms	Consistent, friendly, graphical user interface for clients Communication support Access to Web-based tools Room design teams can collaborate to provide dramatic improvements in facilities	Same as above
Mixed-mode Facilities	Same as above	Same as above
Colocated Team Facilities (members in different locations)	Provides fast connections to enable real-time collaboration	Same as above

at any time, led to less need'for the first two approaches. The Web provides flexibility in running meetings, and it creates interesting issues about how to facilitate such meetings. Time deadlines are generally imposed for each phase of an anytime/anyplace meeting. The deadlines are set to allow for time zones and travel. Another issue for non-face-to-face meetings is that participants want to see the people with whom they are working. Some systems have access to still pictures, while videoconferencing enhances some meeting aspects by showing some body language. We described some major groupware packages earlier in this chapter. In Table 7.1, we provide collaborative computing/GSS and Web impacts. Next, we describe some of the features and structure of a comprehensive GSS through GroupSystems.

7.7 GROUPSYSTEMS MEETINGROOM AND ONLINE

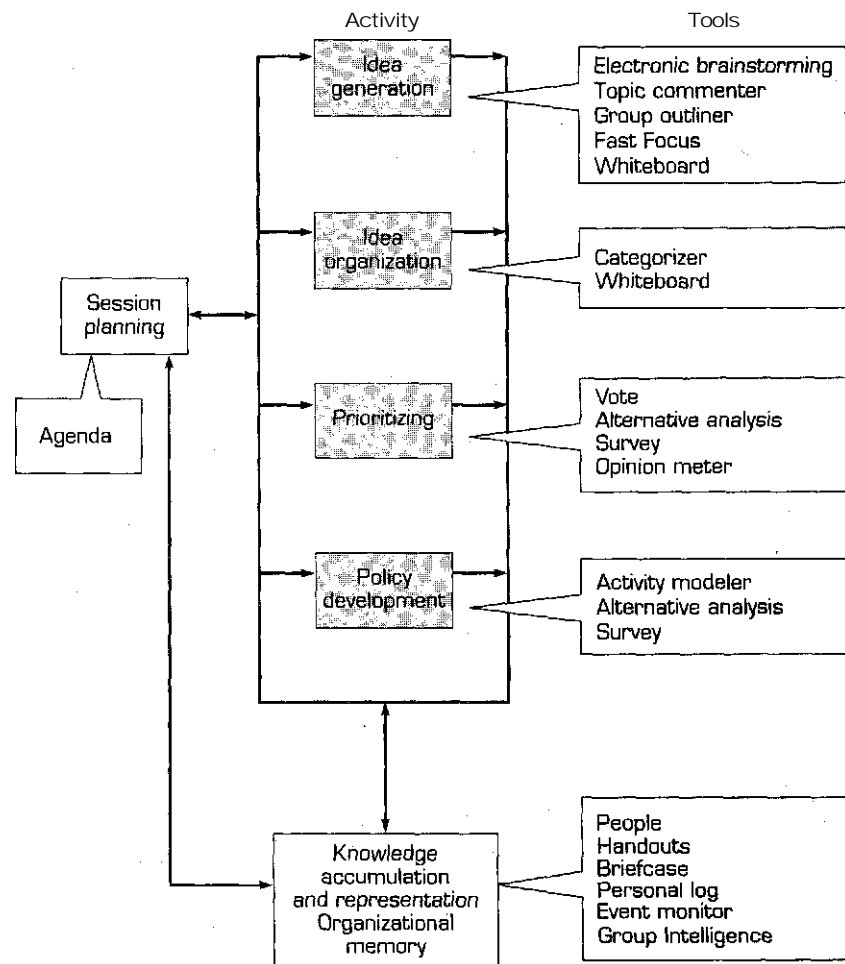
GroupSystems MeetingRoom and OnLine are comprehensive groupware that support a wide variety of group processes. MeetingRoom is the LAN version, while OnLine is the Web-enabled version. Both provide the same set of tools and capabilities. We will refer to the software simply as GroupSystems. An overview of the tools and their rela-

tionship to the major GSS activities is shown in Figure 7.3. Agenda is the control panel for scheduling and running GroupSystems activities, that is, the meeting manager. The tools in GroupSystems are divided into standard tools and advanced tools.

GroupSystems *standard tools* support group processes, including brainstorming, list building, information gathering, voting, organizing, prioritizing, and consensus building:

- *Electronic Brainstorming* gathers ideas and comments in an unstructured manner. Groups work rapidly in generating a free flow of ideas. Participants contribute simultaneously (parallelism) and anonymously.
- *Group Outliner* allows the group to create and comment on a multilevel list of topics in a tree or outline structure. Participants can attach comments at every level of the outline. Comments are integrated and collaborative.
- *Topic Commenter* allows participants to comment on a list of topics. This idea generation is more structured than that of Electronic Brainstorming but less structured than that of Group Outliner.

FIGURE 7.3 STRUCTURE OF GROUPSYSTEMS FOR WINDOWS



- *Categorizer* allows the group to generate a list of ideas and supporting comments. Categories are created for the ideas, and participants can drag the ideas into the desired category.
- *Vote* supports consensus development through group evaluation of issues. Several voting methods are provided. Results are tabulated electronically and displayed statistically or graphically.

GroupSystems *advanced tools* include add-ins for analysis, surveys, and modeling:

- *Alternative Analysis* allows the group to weight or rate a list of alternatives against a list of criteria because collaborative decisions require the evaluation of multiple perspectives and ideas. The group can test what-if assumptions by adjusting the weighting of the criteria.
- *Survey* allows the creation, administration, and analysis of an online questionnaire.
- *Activity Modeler* provides user-friendly group support for simultaneous business process reengineering modeling.

In addition, the *Group Intelligence* module enables teams to capture and incorporate the organizational memory from previous group sessions and combine, publish, and apply them to a new session.

Agenda (the control panel) supports the facilitator. Through *Agenda*, the facilitator plans and runs the meeting and captures and saves session reports and data.

GroupSystems includes several other group resources:

- *People* contains a list of participants with background information.
- *Whiteboard* is a group-enabled drawing and annotation tool.
- *Handouts* are reference materials for group viewing.
- *Opinion Meter* is a fast, simple version of the vote tool for gauging opinions.

The following *individual resources* improve individual productivity:

- *Briefcase* allows access to commonly used applications (word processing, calculators, e-mail).
- *Personal Log* allows personal note taking.
- *Event Monitor* informs members of new activities and information.

7.8 THE GSS MEETING PROCESS

Face-to-face, same time/same place electronic meetings generally follow a common progression. First, the group leader meets with the facilitator to plan the meeting (this is critically important), select the software tools, and develop an agenda. Second, the participants meet in the decision room, and the leader poses a question or problem to the group. Third, the participants type their ideas or comments (brainstorm), and the results are displayed publicly. Because the participants can see what others are typing on their own monitors, they can provide comments or generate new ideas. Fourth, the facilitator, using idea organization software, searches for common themes, topics, and ideas, and organizes them into rough categories (key ideas) with

appropriate comments (new research is attempting to automate this part of the electronic meeting). The results are publicly displayed. Fifth, the leader starts a discussion, either verbal or electronic. The participants next prioritize the ideas. Sixth, the top five or ten topics are sent to idea-generation software following a discussion. The process (idea generation, idea organization, prioritization) can be repeated or a final vote can be taken.

The major activities of a typical GSS session are listed in DSS in Focus 7.11. For examples of GSS use in practice, see DSS in Action 7.10 and the GroupSystems.com Web site (groupsystems.com).

Anytime/any place meetings have become a standard approach because of the proliferation of Web-based GSS. Some differences are that participants want to know about the other participants (if they are not using videoconferencing concurrently or have never met the other participants), task completion times must be assigned (especially if the meeting spans multiple time zones), and the facilitator's task becomes more difficult, especially when the meeting runs around the clock (McQuaid et al., 2000). Deadlines are imposed so that the group can move on to the next phase of the meeting. The same issues affect distance learning environments.

It is very important to remind participants of where they are in the group meeting process and to keep them focused on long-term tasks. Other issues include security (to protect valuable information from theft), universal access (from home or other sites), folder invitations and information (participants must be invited to participate in meeting segments), information about the participants (on virtual business cards), indicating who is on the system (to alleviate feelings of loneliness), and facilitator controls (to start and stop sessions, and restrict access to activities). *Planning the session* is the most critical issue. Facilitators must provide incentives and develop investment in the out-

DSS IN FOCUS 7.11

THE STANDARD GSS PROCESS



1. *Idea generation.* This exploratory step looks at the problem and attempts to develop creative ideas about its important features. The ideas can have anything to do with the problem, from potential solutions to criteria to mitigating factors. An electronic brainstorming tool is appropriate; its output is a list of ideas. Typical time is 30-45 minutes.
2. *Idea organization.* An idea-organizing tool places the many ideas generated on a list of key issues. The output of this stage is a list of a few key ideas (about one for every 20 original ideas) with the supporting details. Typical time is 45-90 minutes.
3. *Prioritization.* At this stage, the key ideas are prioritized. A voting tool is appropriate; its output is a prioritized list of ideas and details. Typical time is 10-20 minutes.
4. *Idea generation.* New ideas are generated based on the prioritization of the key ideas. A brain-

storming tool that provides structure, such as Topic Commentator, is appropriate here. The ideas generated are typically focused on solutions. This stage's output may consist of about 20 ideas for each of the original key ideas.

The process continues until a final idea is selected as a solution to the problem that prompted the meeting, or a few solutions are identified to be investigated in more depth. Some meetings are oriented to decision-making. Others are exploratory in nature and are focused simply on generating ideas to pursue in follow-up meetings or individual work. Often a GSS meeting takes longer than a nonsupported one, but participants are generally more thorough in their brainstorming and analysis, and they "feel" that they have made a better decision using the system. See Nunamaker et al. (1991) for more details.

come, communicate often and explicitly, assign roles and tasks with accountability, and be explicit in goal and activity communication.

GSS SUCCESS

The success of a GSS is based mostly on its effectiveness. A system succeeds if it cuts costs (especially travel costs, see DSS in Action 7.13), supports participants in making better decisions, and/or increases productivity substantially (see the Opening Vignette, Case Application 7.1, the WELCOM Web Chapter, DSS in Action 7.4 and 7.10). In order to succeed, a GSS needs many of the usual information system success factors: an organizational commitment, an executive sponsor, an operating sponsor, user involvement and training, a user-seductive interface, and so on. The executive sponsor and organizational commitment through him or her are critical for success. If the organizational culture does not readily support face-to-face collaboration, then it must be *changed* to do so before introducing GSS (see DSS in Focus 7.12). Otherwise, the system will not be used, and it will be deemed a failure. This is the critical issue in knowledge management (see Chapter 9), which involves collaboration at the enterprise level. Having a dedicated, well-trained, personable facilitator is critical. Finally, the GSS must have the correct tools to support the organization's groupwork and must include *parallelism* and *anonymity* to provide process and task gains. *Good planning* is the key to running successful meetings, and this also applies to electronic meetings (see DSS in Focus 7.5). If anything, bad planning might make a group believe that the GSS is to blame for its poor performance. Finally, GSS must demonstrate cost savings, either through a more effective and efficient meeting process or through reduced travel costs.

DSS IN FOCUS 7.12

CRAFTING A COLLABORATIVE CULTURE

Collaboration is about people; and if you want people to collaborate, the collaboration tool will not change their attitudes. Technology provides around 20 percent of the solution. The rest involves how to motivate the users to really use the system. The managers must create a workplace that supports collaboration. This involves three simple steps:

1. *Know what you want.* Get team members to articulate their definition of *success*. This is part of the team-building process. At Boeing-Rocketdyne, the team created a formal contract indicating goals and how the team would function (an excellent idea for class groups).
2. *Determine resource constraints.* These include everything from the geographic distribution of

team members to reporting relationships to motivations. Each constraint limits the possible tools the team can use.

3. *Determine what technologies can be used to overcome resource constraints.* Keep in mind business needs rather than fun, new, or convenient technologies. For example, videoconferencing and detailed product and code design work require high-bandwidth connections.

Once all this is determined, one must still set up group sessions- with good facilitation to guide and train the participants in tool use. A learning environment is ideally created in the process.

Source: Partly adapted from Agrew (2000).

7.9 DISTANCE LEARNING

According to SRI Consulting, the online learning and institutional training market will grow to exceed \$20 billion by 2005 (see Sistek-Chandler, 2001). Developments in distance learning technologies continue to change the way courses are delivered—and received. Traditional courses also benefit from the new technologies. In this section, we describe background and advances in distance learning, and how they relate to GSS.

LEARNING, COLLABORATIVE COMPUTING, AND GSS

The classroom is a natural setting in which to enhance learning by providing computerized support, either as a supplement of through complete *courseware*. Learning is the basic process of incorporating new knowledge into one's own set of knowledge. It typically involves the sequence of predetermined steps outlined in DSS in Focus 7.13. The learning process generally requires *communication* and *collaboration*. Collaborative computing (GSS) can improve the classroom experience. GSS features like brainstorming (a form of discussion or chat) and voting can support class members performing groupwork. GSS use in the classroom increases observed learning, self-reported learning, on-task participation, and satisfaction. On the other hand, anonymity and other GSS features can introduce some process losses into the education process, such as flaming and buffoonery, which must be planned for by the instructor and thoughtfully managed (see Schweizer, 1999). The instructor must control flaming and buffoonery, and run discussions in an electronic medium in much the same way as in a traditional classroom (see DSS in Focus 7.14).

The Web is an effective vehicle for distributing course materials, including lecture notes. Even with the availability of detailed course materials, class attendance does not seem to drop off. (Not attending class is ill-advised. Educational research indicates that class attendance is the most significant factor in course success.) Textbooks feature Web sites with separate areas for students and faculty. Even simple collaborative computing technologies like e-mail and listservs can enhance the educational experience,

DSS IN FOCUS 713

WHAT IS LEARNING?

A learning process normally incorporates

1. Establishing the objectives of the learning process.
2. Finding and revising (or creating) instructional material.
3. Assessing students' levels of knowledge.
4. Assigning appropriate material to students.
5. Defining the form of access students have to components or modules.
6. Revising and following up students' progress and intervening when necessary.
7. Providing and managing communication between students and instructors and between students.
8. Assessing the learning process.
9. Preparing reports on the learning process results.

Source: Adapted from UCAID, "The Internet! Project," internet2.edu, May, 2003. Also see "Exploring the Future of Learning—The Internet2 K20 Initiative" at k20.internet2.edu/projects/mu_thinkquestlive2002.html.

DSS IN FOCUS 7.14

HOW TO RUN ONLINE DISCUSSIONS

According to Schweizer (1999), professorial roles in online discussions are very much the same as in face-to-face discussions. She recommends the following ways for the professor to fit into the discussion:

- Use online discussions to build a community. Be informal about your tone in the discussion.
- Relate online discussions to current class material. Refer in class to issues raised in the discussions. In class, if a student want to pursue a point (and you have no time), move it to the online discussion.
- Structure the discussion topic; focus it around a problem to be solved. Assign one student the task of providing an intial solution. Everyone else must refine it.
- Define roles for various discussants. They might include: original proposer, idea extender, constructive critic, responder to critic, consolidator, etc.

Clarify the reward for participation. This could involve grades or even enhancing knowledge for the exam. Exam questions may even be derived directly from discussions.

Outlaw "just opinions." Insist that points must be backed by specific references to readings, other discussants, other source materials, or analysis that the student has performed.

Keep a discussion board as a "for fun" place where students can post anything they wish as a means of letting other students know them better. The professor may or may not subscribe to this discussion list.

Source: Expanded from David G. Brown, "The Role You Play in Online Discussions." *Syllabus*, December 2002.

as the text authors can attest. A critical success factor is that class members and instructors be properly trained in technology use.

WHY USE COLLABORATIVE COMPUTING IN LEARNING?

Tyran and Shepherd (2000) describe an interesting research framework for collaborative technology use (GSS) in the traditional classroom. There are factors related to the context of the group learning situation, the group learning process, and the outcomes of the learning process. Alavi et al. (1995) showed that students in a distant collaborative environment exhibited a higher level of critical thinking and were more committed to and cohesive with their teams. It seems to be a worthwhile effort to move courses online.

Collaborative computing technologies are directly applicable to distance learning environments. By the end of the 1990s, technology had advanced to the point where computer-supported traditional classes could move to online, Web-based distance-learning environments. There is a definite need to enhance existing classrooms with collaborative support and to make education available outside the confines of the classroom. See Lau (2000), and Tschang and Senta (2001).

DISTANCE LEARNING

Distance learning (DL) takes place when learning involves tools or technologies designed to overcome the restrictions of same time/same place learning. The history of distance learning in the United States dates back to 1728, when an advertisement in

The *Boston Globe* offered shorthand lessons through the mail. Bunker (1999) and Matthews (1999) provide the history of DL.

Distance learning is exciting and has unlimited potential to revolutionize learning at universities and colleges, at public and private schools, and in corporate on-the-job training. But distance learning is not a new concept! When television was invented in the 1920s, it was heralded as a device that would revolutionize education. Radio was used in the 1920s and 1930s for distance learning programs (it is still so used in the Australian Outback), and video distance learning systems have been in operation for decades (see DSS in Action 7.15 for the "early" experiences of one author). Now that technology has evolved, television, or rather videoconferencing and collaborative computing through the Internet, is finally fulfilling its destiny by providing support tools to enable distance learning.

Internet and videoconferencing and collaborative computing tools customized to the classroom environment allow inexpensive and widespread distance learning. Distance learning has developed into a substantive sector of higher education around the world over the last few decades. It is becoming an increasingly popular alternative to traditional degree programs and workshops. DL is a nontraditional way of deliver-

DSS IN ACTION 7.15

DISTANCE LEARNING - DĚJA VU? AGAIN?

In 1980 I accepted a position as an assistant professor at Southern Methodist University (SMU). During my interview, I discovered that about half my teaching would be "education at a distance" through the TAGER Network (the Association of Graduate Education and Research Network—now the Green Education Network), a closed-circuit television system over which almost all of the master's-level programs in engineering were offered (see engr.smu.edu). TAGER, operational since 1964, is a consortium of five colleges and universities and many companies in the Dallas-Fort Worth Metroplex. TAGER broadcasts courses from the colleges and universities to the firms. The video and audio signal is sent via closed-circuit microwave, while the talk-back from students off campus is by way of leased phone lines (audio only). The firm is obligated to provide a media classroom for the course and allow students to attend. On campus there are four classroom studios, each equipped with two cameras (one in the rear and one overhead).

Students saved driving time (up to three days per week—possibly 80 miles (130 km) each way—and in many cases this was the only way they could pursue a graduate degree), while the universities were able to increase class sizes without requiring additional space and, more important, to attract high-level, highly motivated students who enriched the classroom experience for all. In 1978 the program was expanded to include

videotape that could be mailed anywhere in the world. In the mid-1980s, SMU joined the National Technological University (NTU) as a member school. NTU offers its own degree programs, but students attend classes from any member school, generally beamed by satellite to their workplace. This enhanced career portability for part-time students.

It did not take me long to figure out that telephone office hours would be necessary and that the class would require a lot of extra preparation time. Even so, the preparation paid off when the course was offered a second time. There were a few other benefits: A faculty member who had to miss class (which rarely happened, of course) could record the lecture in advance; I got really good at identifying students by their voices, to the point that when they came to my office I could recognize them as soon as they spoke; and the evidence of a very occasional academic honesty issue could be recorded on videotape.

Even though this technology seems quite passe now, it was remarkably robust and challenging then, and a good experience for the students and the faculty. Many of the lessons, tips, and research topics I now see in distance learning articles are the same ones that I experienced, learned, or developed on the fly in the early 1980s.

Source: Jay E. Aronson.

ing education and focuses on working professionals whose primary requirement is the element of convenience. Student profiles have changed dramatically over the last two decades. As the economics of education and socioeconomic trends evolve, students are completing their college educations in nontraditional ways. Thousands of educational institutions worldwide offer courses through DL, not including the comparable if not larger number of independent companies offering remote education courses. Continuing Education, required of many professional fields from medicine to engineering is readily offered via distance-learning systems (Morris, 2003). In early 2003, there were an estimated 350,000 students enrolled in fully online degree programs (Dunham, 2003), and the numbers continue to grow daily.

A scan of the literature in 2004 indicates that distance learning has gone global. It is especially important in Third World countries that can use Internet, telephone, satellite, radio, and television links to span great distances to deliver education, especially in the primary and secondary grades. And in more developed countries, governments are setting up digital curricula, both to provide inexpensive education resources to their citizens (see Ashling, 2003; Telecomworldwire, 2003), and to alleviate public school teacher shortages, as in Texas (Raghunathan, 2002). Even Latin is being taught online (for a personal experience, see Shelton, 2000).

Most major colleges and universities utilize technology to offer a variety of sophisticated distance learning programs. Hundreds of fully accredited colleges and universities in the United States offer DL-delivered degrees in thousands of fields. Almost all offer bachelor's degrees, and most offer master's degrees. Many offer certificate programs as well. There are over a hundred distance learning MBAs (see Dearlove and Crainer, 2001) and doctorate programs. Programs ranged from those delivered by traditional institutions to those sponsored by Jones International University—a virtual campus only. See Petersons.com, ECollege.com, www-icdl.open.ac.uk/icdl/, and usdla.org for information about specific distance learning programs. See Moloney and Tello (2003) and Riffie (2003) to learn how to create successful online education. Also see Brooks et al. (2001), Buck (2001), and Gilbert (2001).

For an example of an executive MBA program offered as a blend of on-campus experience and distance learning technology at the University of Georgia, see DSS in Action 7.16. For experiences involving moving courses and blended courses to online environments, see Dollar (2000), Schell (2000), Stith (2000), and Warnock et al. (2000). There is a trend for organizations to partner with universities in structuring degree programs and courses. The UGA/IBM program described in DSS in Action 7.16 is a good example. Goodridge (2002) additionally describes how IBM and Microsoft have structured successful master's degrees with several leading universities. General Motors has partnered with Cardean University in an online MBA program (see Goodridge, 2001a). DL programs have many advantages, but also, unfortunately, some disadvantages.

ADVANTAGES OF DL PROGRAMS³

- Learning can be as effective as by traditional means, or even more so.
- The flexible time frame provides educational opportunities for many, including senior managers and executives.
- Students need not quit their jobs.
- Students can travel as part of their existing jobs.
- Access is available anywhere and anytime.

³Partly adapted from Jana (2000) and Schell (2000).

DSS IN ACTION 7.16

THE BLENDED-LEARNING MBA

The University of Georgia and Pricewaterhouse-Coopers (PWC) (now part of IBM) have partnered to pioneer a new kind of MBA program. The two-year program blends distance, classroom, and team learning with technical and business courses.

The program begins with all enrolled students visiting the campus for two weeks to meet the faculty and get to know each other. After the first week, students split into teams of about five people, and they work within these teams for the rest of the school year.

The teams write a contract to define their responsibilities and commitments, such as the amount of time to be spent on conference calls and how to handle collaborative research. The contract can also include consequences for people who don't live up to their responsibilities. After the two-week stint, consultants return to work. Each week, they log on to Blackboard (courseware) via the Web to listen to prerecorded lectures and complete weekly reading assignments. The teams participate in conference calls as needed. Each semester students regroup at The University of Georgia for on-site learning for a week.

This program readily handles logistical and content problems with traditional full-time programs (difficult because of the one- to two-year commitment away from work) and typical part-time programs (the employees travel in their consulting). At the time when the program began, pure distance learning MBA programs were still evolving. This blended-learning program provides students with many of the benefits of both an on-campus experience and a distance learning environment. An additional benefit is that since the spring 2003 semester, Blackboard has become standard courseware for all Terry College of Business courses. Traditional courses can exploit many of the features of courseware to enhance the learning environment.

Source: Adapted from J. Mateyaschuk, "An MBA on the Go," *InformationWeek*, No. 744, July 19, 1999; also see J. Reingold, and M. Schneider, "The Executive MBA Your Way," *BusinessWeek*, No. 3651, October 18, 1999, and The University of Georgia, MBA Program Documentation, 2004; also see Bostrom, Kadlec, and Thomas (2002).

- **New technology can be presented to a large audience cheaply.**
- **Online classes can teach specific skills.**
- **Online classes cost less.**
- **More information can be made available to students, adding breadth and depth to a course.**
- **It is possible to have more one-on-one interaction with an instructor (through e-mail).**
- **Student/faculty contact time increases.**
- **DL meets the need for continuous learning.**
- **The course materials are consistent.**
- **Attendance is not required and can be handled flexibly (a plus and a minus).**
- **The technology can handle "discussion-style" courses as well as technical courses.**
- **Students' attitudes evolve and improve as familiarity with the technology increases.**
- **Students show positive gains in learning.**
- **Impacts (higher learning levels, higher test scores) have been observed to be greater in online courses (Dollar, 2000; Reid, 1999).**

DISADVANTAGES OF DL PROGRAMS⁴

- **There are fewer (or very different) social interactions (lack of face-to-face meetings).**
- **There is less or no on-campus interaction.**

⁴Partly adapted from Jana (2000) and Schell (2000).

- There can be communication problems (especially with video).
- Students must be highly self-motivated and tightly focused.
- Students must be highly disciplined and organized.
- Students must have effective time management skills.
- Students must be extremely dedicated.
- Online classes require major administrative support.
- Online classes require major technical support.
- Faculty preparation and delivery time is significantly higher than for a traditional course (up to three times the time and effort is needed).
- Courses must be redesigned to utilize the best presentation mechanisms for topic delivery.
- Extra rewards for faculty are recommended because of the extra effort (could be a plus).
- Faculty need special training in effective instruction methods and in the technology.
- Students need special training in the technology.
- The course requires a *very reliable* technological infrastructure, including hardware, software, and a *trained* staff.
- The learner must assume much more responsibility.
- Mastery of the material establishes the grade, though collaborative methods allow an instructor to identify contributors.
- Students must work hard—these are real courses, not correspondence courses.

DISTANCE LEARNING COURSEWARE

There are hundreds of courseware packages that enable distance learning. These range from more general collaboration tools like Lotus Notes, Microsoft NetMeeting, Interwise, Groove, PlaceWare, WebEx, and GroupSystems to specialized courseware from the popular Blackboard (Figure 7.4) and WebCT Vista to Lotus Notes Learning Space and the PlaceWare Virtual Classroom.

Blackboard (www.blackboard.com) is powerful courseware that handles all aspects of online learning in a Web environment. The University of Georgia program described in DSS in Action 7.16 uses Blackboard for student interaction through establishment of groups, discussion lists and virtual classrooms (both among group members and among all class members), document sharing, e-mail between students and between students and faculty, submission of assignments, and feedback. Lectures, lecture notes, PowerPoint (or other) presentations, the syllabus, and all course handouts and materials are available on Blackboard. Online exams and quizzes are established directly and managed automatically. Question types include true/false, multiple choice short word, matching, and paragraph answer. Student exam and quiz results are automatically recorded. The Online Gradebook allows an instructor to enter all grades, with weights; grades are automatically (and privately) reported to students when they log into their accounts (no more posting grades on the door). Finally, a course may be copied into another, so that the documents need not all be reposted manually. Jay Aronson uses it for *all* his classes. See the sample screenshot in Figure 7.4.

LearnLinc Virtual Classroom (EDT Learning) and InterWise allow online instructors to control class presentations using synchronized multimedia and content over the Web. It also offers application sharing, electronic hand raising, and a "glimpse" feature that allows instructors to acquire a screen capture of any student's desktop. One-way streaming video and audio or prerecorded communications, as well as two-way audio

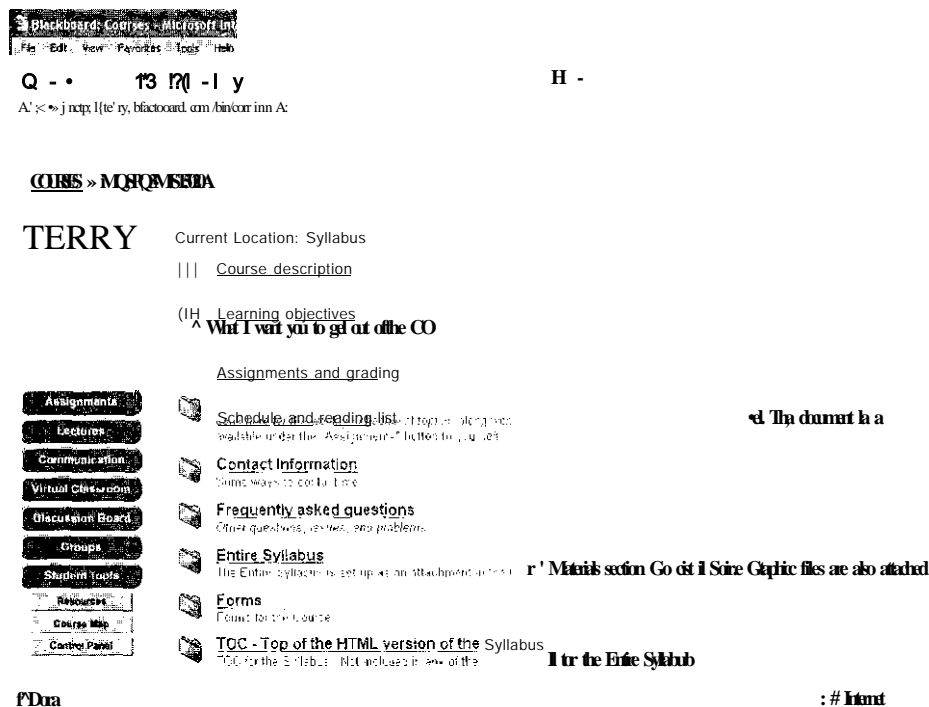


FIGURE 7.4 BLACKBOARD COURSEWARE SCREEN SHOT

Source: Screenshot Capture (©2003) Blackboard.com. Used with permission of Blackboards

in multicast audioconferencing, can be used. TestLinc provides comprehensive testing capabilities. There are many online and journal Buyer's Guides of tools and software for conferences, meetings, and distance learning.

ONLINE CORPORATE TRAINING

More and more organizations are training their employees online, not just in the latest technologies but also in policies, sales, and other areas. Professionals are increasingly pressed for time. Web-based learning technologies allow organizations to keep their staff members up-to-date with the latest innovations, policies, and methods. In 1999 private industry spent \$58 billion annually on employee training. Driven by the demand for cheaper, more interactive courses, online learning is fast becoming the standard operating procedure. Classroom use has dramatically dropped in the first few years of the millennium. Computer-based training costs about 50 percent less than the traditional classroom setting and does not involve travel costs or have class size restrictions. Web-based or online courses accounted for more than half of all training by 2002 (up from 17 percent in 1998). Training via the Web can run 24 hours per day every day (24/7). Web-based training (WBT) can be faster and cheaper than classroom training. IBM estimates a savings of \$500,000 for every 1,000 hours of training outside the traditional classroom. International Data Corporation (IDC) predicts that revenue from

Internet-based training program sales will have grown at a compound annual rate of 64.5 percent through 2003. Advanced electronic learning requires real-time, two-way communication, via either audio- or videoconferencing tools, allowing students and instructors to interact and providing feedback. For most Web training, students view a live or recorded class and participation is limited to posting on bulletin boards and e-mail discussions (see Boisvert, 2000; Kiser, 1999; Markel, 1999; Mottl, 2000).

As outlined by Hickey (2002), the top five reasons for online training are:

1. Slash costs
2. Shorten the learning process
3. Extend your reach
4. Train more, more often
5. Make money (sell your courseware)

In Case Application 7.2, we describe how Dow Chemical utilized online learning to save millions in costs, and to generate opportunities and build trust and commitment among its employees. Charles Schwab & Co. deployed an online training system for its 5,000 call-center representatives (see Swanson, 2000). Distance learning (also called e-learning) has moved out of the office. Even sports teams and emergency workers are utilizing technology to learn new skills and stay proficient in their areas (see Shachtman, 2000).

DISTANCE LEARNING RESOURCES

The following is a sample of organizations and journals involved in promoting and supporting distance learning:

- *Center for Distance Learning at Texas A&M University* (cdlr.tamu.edu). This resource center has a model classroom that can be viewed on the Web.
- *Lucent Foundation Learning and Development Programs at Lucent Technologies* (www.lucent.com/news/foundationlearning.html). Resources include research abstracts, published articles, case studies, and brochures with tips on how to set up a distance learning course or program.
- *American Council on Education ACENET* (acenet.edu). This organization stays current on many important issues in education. It publishes a checklist on how to evaluate the quality of an organization's distance learning program.
- *Online Certification, Education and Distance Learning* (www.ocedl.com). Keeps tabs on the future of distance learning, certification, education, and distance education.
- *U.S. Distance Learning Association* (www.usdla.org). Lists many articles, and links to relevant resources.
- *Distance Education Clearinghouse* (www.uwex.edu/disted/home.html). Lists many articles, and links to relevant resources.
- *American Journal of Distance Education* (www.ajde.com). A current journal on the issues and practice of distance learning.
- *CADE: Journal of Distance Education* (www.cade-acedca). A current journal on the issues and practice of distance learning.

EVALUATION OF DISTANCE LEARNING

Although initially slow to gain acceptance, many corporations are taking advantage of distance learning via Web-based streaming and through private company intranets (Stamberg, 2002). The top e-learning providers are discussed by Hickey (2002). Organizations are taking a serious look at the return on investment of distance learning (see Harris, 2003; Belange and Deannett, 2000). While the jury is still out, academia and industry are attempting to determine the true *value* of distance learning. Clearly, though, corporate training pays off (see DSS in Action 7.17).

Distance learning is a form of collaboration and knowledge management and can be done in a 24/7 framework. It is critical to assess the impact of Web-based courses in terms of benefits and costs. Most student experiences are positive (see Dollar, 2000; Schell, 2000). Students tend to learn more using groupware, especially when learning spans a distance. Students in distance learning environments tend to perform better than those in traditional classrooms (Dollar, 2000). Several factors are important in distance learning situations. A high level of student motivation, a strong work ethic, and intensive student support measures typically result in success for distance learners. The most important factor for achieving success in distance learning is the degree to which instructors and support staff are able to encourage students to undertake responsibility for their own learning. Clearly, collaborative technology can enhance learning performance and increase affective experiences in the context of cooperative learning (Chuang, Bernard, and Shahid, 2002).

Both students and faculty must understand how collaborative technology impacts on how they perform course work. Some issues revolve around training, determining which technology to use and how, what to distribute and when, and what standards to use for files that students submit.

Distance learning is radically changing education, and socioeconomic, technological, and economic changes must be examined as the learning behaviors and expectations of learners change. There is a sharply growing demand for flexible, adaptive, time- and geography-independent learning environments (Meso and Liegle, 2000). Despite its disadvantages, distance learning continues to grow dramatically because of the increased demand.

DSS IN ACTION 7.17

EMPLOYEE TRAINING PAYS OFF

Employee training pays off. Companies tend to lose their value if they cut training programs. If they invest in training, they increase their value. According to the American Society of Training and Development, publicly traded firms that invest in training and development increase their total shareholder return in the following year by between 19.8 percent and 36.9 percent. An increase of \$680 per employee in a company's training expenditures generates, on average, a 6 percent improvement in total shareholder return in the follow-

ing year. As a specific example, consider the First National Bank of Colorado. CEO Dave Gilman invested heavily in training. As a result, the bank's assets have grown from \$228 million to \$650 million. Training also significantly lowered its employee turnover rate.

Source: Adapted from Nancy Nachman-Hunt, "Employee Training Pays Back Big, First National CEO Believes." *Boulder County Business Report*, Vol. 22, No. 2, January 24, 2003. .

7.10 CREATIVITY AND IDEA GENERATION

CREATIVITY

Creativity is complex. It can be considered a fundamental human trait and a level of achievement (see DSS in Focus 7.18 for a formal description of creativity). Personality-related creativity traits (inventiveness, independence, individuality, enthusiasm, flexibility) can be assessed through a 36-item scale called Personal Barriers to Creative Thought and Innovative Action (Hellriegel and Slocum, 1992, pp. 237-238) and the widely used Torrance Tests of Creative Thinking (TTCT) (Cramond, 1995; Torrance, 1988). However, researchers have established that creativity can be learned and improved and is not as strongly dependent on individual traits as originally thought. Innovative companies recognize that creativity may not necessarily be the result of genius as much as the result of being in an idea-nurturing work environment (e.g., see Gatignon et al., 2002; Schmitt and Brown, 2001; Sebell et al., 2001; Leifer et al., 2000). It is also important for a manager to remember that creative individuals tend to have creative lives even outside of the office (see White and Wright, 2002; Williams, 2002).

Once a problem is formulated, potential criteria and alternatives must be identified. Idea generation is an ideal approach. Creative ideas generally lead to better solutions. In brainstorming, there are some specific creativity measures: the quantitative (number of ideas) and qualitative (quality of ideas) components. Both can be positively impacted by the use of a creativity support system (CSS) (essentially a GSS) (Wierenga and van Bruggen, 1998; Massetti, 1996).

Many organizations recognize the value of creativity and innovation (see Bean and Radford, 2001). They are aware of the collaborative nature of creativity and the kinds of environments that foster it (e.g., one critical aspect required for creativity is permission to fail: the Post-it Notes adhesive from 3M Corporation was a dismal failure as a superglue but became remarkably successful once a purpose was discovered for a weak adhesive). Organizations that are remarkably creative tend to have failure as a way of life (see Sutton, 2001; Murphy and Khiralla, 2000; Nelson and Wawiora, 1999). Creativity and innovation go hand in hand. Quite often what seems like a bad idea at first becomes the source of a creative innovation many years later. For example, the limiting factor in building a mile-high skyscraper (designed in 1956 by Frank Lloyd Wright) was the fact that cabled elevators could not ascend that far. About 40 years later, Otis Elevator Company unveiled a viable prototype (that could even transport people sideways). Fundamental innovations can take 15-25 years to reach fruition (Port and Carey, 1997).

Schrage and Peters (1999) believe that collaboration, serious play, and prototyping (serious trial and error—mostly error) are necessary to foster creativity. The workplace should be a fun place for the innovative knowledge worker. Play involves improvising with the unanticipated in ways that create new value. Creative processes cannot be managed the same way that conventional incremental improvements are. "Innovation can be nurtured and guided by setting soft goals, by evaluating progress with a shrewd eye toward long-range strategy and changes in the outside world, and by creating a climate that encourages bold thinking" (Port and Carey, 1997). The "creative class" must be managed in such a way that the nature of the job and the structure of the work environment meet the members' inner needs and desires (see Florida, 2002a, 2002b). A manager fostering creativity should "allow and enable" rather than structure and control, according to John Kao, founder and CEO of the Idea Factory (Silverstone, 1999). Vance and Deacon (1997, 1999) claim that to encourage creativity it is important to be

"outrageous" in our attitudes and activities (also see Kaneshige, 2000). Thinking outside the box unleashes creative energy. It is important to develop many simulations (prototypes) that eventually (hopefully) will lead to a success (possibly after many failures; Thomas Edison had over 1,800 failures before he developed a sustainable light bulb). Schrage and Peters (1999) advise: "Be willing to fail early and often; know when the costs outweigh the benefits; know who wins and who loses from an innovation; build a prototype that engages customers, vendors, and colleagues; create markets around prototypes; and simulate the customer experience." Once creativity is unleashed, it can dramatically enhance the bottom line in the long run. Creativity is important in problem-solving (see Handzic and Cule, 2002), and thus it is critical to develop computerized support systems for it.

Creativity and innovation can be stimulated by a number of environmental factors. An environment that meets the "serious play" criterion is part of the process. Stimulation by other creative people in the environment can push a group forward. How? Some stimulation can come directly from exciting ideas developed as a consequence of association (or synergy) among creative people. This can be done formally by presenting a person with a string of related (even distantly related) concepts. And, some stimulation comes from friction among employees. Some research suggests that some dissatisfaction and discomfort is a must to spark innovation. One should not hire people like oneself. The differences cause stimulation; for example, in brainstorming they broaden the viewpoints (see Sutton, 2001). These differences were capitalized at Boeing-Rocketdyne in using a GSS, as Malhotra et al. (2001) describe: "Innovation, most often, comes from the collaboration of individuals from a cross-section of disciplines, inside and outside of an organization."

A number of association methods have been proposed and empirically proven to be effective in stimulating creativity. And viewing ideas in a different frame (again outside the box, from different angles, etc.) can stimulate creativity (see von Oech, 1998, 2002, and Creative Think at creativethink.com). Next we discuss creativity and innovation in the context of idea generation and electronic brainstorming.

DSS IIM FOCUS 7.18

WHAT IS CREATIVITY?

Creativity is fairly complex to define formally but very easy to recognize when you see it. Formally, *creativity* can be defined as either a trait or an achievement (Eysenck, 1994). As a trait, creativity is a dispositional variable characteristic of a person leading to the production of acts, items, and instances of novelty. As an achievement, we refer to the creative product—for example, the output of a process, such as the "quality" of the ideas generated in an electronic brainstorming session. Creative achievement may depend on the trait of creativity but also on much more. Formal research has found that the following variables affect creativity as achievement: cognitive variables (intelligence, knowl-

edge, skills, etc.), environmental variables (cultural and socioeconomic factors), and personality variables (motivation, confidence, and creativity as a trait) (Eysenck, 1994, p. 209). Studies of factors affecting the creativity of marketing programs describe three classes of influencing factors: problem-solving inputs, situational factors, and motivational factors (Andrews and Smith, 1996). These factors are very similar to Eysenck's variables. All in all, experts know when they see creative traits and achievements.

Source: Partly adapted from Wierenga and van Bruggen (1998).

IDEA GENERATION THROUGH ELECTRONIC BRAINSTORMING

Idea generation methods and techniques have been adopted to enhance the creativity of both individuals and groups. Idea generation software (electronic brainstorming) helps to stimulate the free flow of turbulent creative thinking: ideas, words, pictures, and concepts set loose with fearless enthusiasm, based on the principle of synergy (association). Some packages are designed to enhance the creative thought process of the human mind and can be used to create new product ideas, marketing strategies, promotional campaigns, names, titles, slogans, or stories, or just for brainstorming.

Bombarding the user with many ideas is a key feature of idea generating software. This is critical because it helps the user move away from an analytic mode and into a creative mode. Psychological research indicates that people tend to anchor their thoughts early on, using their first ideas as springboards for other ideas. Therefore, subsequent ideas may not be significantly new, but simply minor variations of the original idea. Because brainstorming software is free of human subjectivity, it can help broaden the thinking platform and encourage truly unique ideas to emerge. Recent studies have characterized creativity and how it can be enhanced by software tools.

By definition, idea generation in GSS is a collaborative effort. One person's idea triggers another's ideas, which trigger even more ideas (in *idea chains* developed by association). With collaborative computing-support tools (e.g., GSS), the individuals do all the thinking while the software system encourages them to move along. The technology is an anonymous, safe way to encourage participants to voice opinions that they might be reluctant to express in a more conventional setting. By building on each other's ideas, people can obtain creative insights they did not have before, based on associations with existing ideas and with their memories. There is a percolation effect as ideas work their way through the process. Associations trigger memories that can activate creativity. The exchange of information (learning) can lead to increases in output and creativity (Dennis, 1996; Dennis et al., 1997/1998; Rees and Koehler, 1999). There are many relatively inexpensive idea generation packages on the market.

Under the right electronic brainstorming conditions, more ideas and ideas that are more creative overall can be generated. A number of different conditions have been explored. Aronson et al. (2000) investigated time-pressure impacts on idea generation and quality. Time pressure matters. Dennis et al. (1997) studied single versus multiple dialogues in brainstorming, and Dennis et al. (1999) examined the impact of decomposing a problem by time periods or by task. Massetti (1996) investigated the impact of different brainstorming tools on creativity, and Hilmer and Dennis (2000) studied categorization impacts.

Generally, if the right approach is used in electronic brainstorming, more ideas and more creative ideas are generated. But a word of caution is in order. Sometimes a group may experience a process gain in the number of ideas and the number of creative ideas but also experience a process loss resulting from *information overload*. The results of each idea generation session can be stored (GSS provides organizational memory) so that they can be carried over from one meeting to another to enhance the creativity of more people.

What if an individual needs to brainstorm alone? There are methods for enhancing individual brainstorming. Satzinger et al. (1999) developed simulated brainstorming to help individuals trigger more creative responses when brainstorming alone. They compared the impact of a simulator that randomly generates ideas to an individual decision-maker, versus an individual decision-maker not using a simulator in brain-

storming. The participants using the simulator generated more ideas and more creative ideas than the others.

Research on how a group should organize itself to generate ideas shows that, in contrast to findings on non-computer-mediated idea generation, a single GSS-supported group generates more ideas of higher quality than the same number of participants working as individuals or in several smaller groups (Bostrom et al., 1993). Web-based systems for idea generation (all the groupware mentioned earlier in this chapter) are readily available.

Loosely related to brainstorming, cognitive maps (e.g., Banxia Decision Explorer) can help an individual or group understand a *messy* (wicked) problem, develop a common frame, and enhance creativity. A cognitive map shows how concepts relate to each other, thus helping users organize their thoughts and ideas. In this way they can visualize the problem they are trying to solve (Lipp and Carver, 2000; Sheetz et al., 2000).

CREATIVITY-ENHANCING SOFTWARE

Though electronic brainstorming enhances creativity, it is primarily human beings who produce the results. In the next two subsections we describe software and methods that enhance human creativity by actually performing some of the creative tasks of a human being. Some of these systems actually exhibit creative behavior.

COMPUTER PROGRAMS THAT EXHIBIT CREATIVE BEHAVIOR

For several decades people have attempted to write computer programs that exhibit intelligent behavior. A major characteristic of intelligent behavior is creativity. Can computers be creative?

Intelligent agents (smartbots) can function as facilitators in GSS. Chen et al. (1995) describe an experiment in which an intelligent agent assisted in idea convergence. The agent's performance was comparable to that of a human facilitator in identifying important meeting concepts, but inferior in generating precise and relevant concepts. But the agent was able to complete its task faster than its human counterparts. This concept is in its infancy but has potential for supporting Web-based GSS, where the facilitator cannot be available on a 24/7 basis.

Rasmus (1995) describes three creativity tools. The first one is called Copycat, a program that seeks analogies in patterns of letters. Identifying patterns is the essence of intelligence. Copycat, consisting of several intelligent agents, can find analogies to strings of letters (e.g., find an analogy for transforming *abc* to *abd*). This ability can be generalized to other problems that require conceptual understanding and the manipulation of objects. The ability of the program to anticipate the meaning of the transformation and find analogous fits provides evidence that computers can mimic a human being's ability to create analogies. The second system, Tabletop, is also capable of finding analogies. A third system, AARON, is a sophisticated art drawing program and the result of 15 years of research. Its developer, Harold Cohen, created a comprehensive knowledge base to support AARON. Similar computer programs have been developed to write poems and music and create works in other media. The increased knowledge base, processing speed, and storage now available enable such programs to create artwork of good quality.

CREATIVITY SOFTWARE ALTERNATIVES TO IDEA GENERATION

Goldfire (Invention Machine Corporation, Cambridge, MA, invention-machine.com) is an intelligent partner that accelerates technical innovation. Goldfire's semantic processing technology reads, understands, and extracts key concepts from company databases, intranets, and the Internet. The software reads the content, creates a problem solution tree (knowledge index), and delivers an abstract listing of the technical content in relevant documents. Goldfire uses scientific and engineering knowledge as the foundation for its semantic algorithms to accelerate new product and process design innovations.

Goldfire is based on the theory of inventive problem-solving (TRIZ—a Russian acronym). TRIZ was first developed by Genrich Altshuller and his colleagues in Russia in 1946. Over 2 million patents were examined, classified by level of inventiveness, and analyzed to look for the following innovation principles:

1. Problems and solutions repeated across industries and sciences.
2. Patterns of technical evolution repeated across industries and sciences.
3. Innovations using scientific effects outside the field where they were developed.

The TRIZ creative process is described on the Web sites of the *TRIZ Journal* (triz-journal.com) and Ideation International (ideationtriz.com).

SOFTWARE THAT FACILITATES HUMAN CREATIVITY

There are several good software packages that can help stimulate creativity. Some have very specific functions, and others use word associations or questions to prompt users to take new, unexplored directions in their thought patterns. This activity can help users break cyclic thinking patterns, get past mental blocks, or overcome procrastination. Such software can use several different approaches to release the user's flow of ideas. ThoughtPath, Creative WhackPack, and IdeaFisher are just a few of these packages.

ThoughtPath (Synectics Company, www.thoughtpath.com) enhances creativity by walking a user through a series of steps that have demonstrated success in practice. ThoughtPath guides the user through problems and opportunities toward a creative, workable solution. It helps users gain insights into their problems and issues. ThoughtPath is designed to promote outside-the-box thinking. A tour is available on the Web.

Creative Think (creativethink.com) provides the Creative WhackPack (based on von Oech, 1998), a deck of 64 cards that will "whack" you out of habitual thought patterns and let you look at your problem in a new way. The cards ("a physical package") are designed to stimulate the imagination. Fortunately, all 64 illustrated cards are up and running on the Web site (as software); you can select the Give Me Another Creative Whack button to select one at random.

IdeaFisher has an associative lexicon of the English language that cross-references words and phrases. The associative links make it easy for the computer to provide the user with words related to a given theme on some level, based on analogies and metaphors. Many such nonlinear associations can be outrageous, but as mentioned earlier, outrageousness can often trigger new, useful (and profitable) ideas. Personal associations can also be added to the database to broaden its creative application base. IdeaFisher has been described as "a thesaurus on steroids." IdeaFisher has many add-

DSS IN ACTION 7.19

T

FISHING FOR IDEAS WITH IDEAFISHER

IdeaFisher (ideafisher.com) has three components: QBank, IdeaBank, and Notepad. QBank's questions are organized to assist in formulating an exact problem more accurately; a series of modification questions encourage the user to branch into different lines of thought, and a series of evaluation questions help the user to test and compare the quality of creative ideas to the original objective. This list of central ideas can then be used to decide what to pursue in IdeaBank.

IdeaBank is a massive database of idea words, concepts, and associations with the cross-referencing power of a huge number of direct idea associations and a very large number of secondary (linked) associations. The inclusion of polar opposites stimulates an even larger group of associations.

For example, using the word *car*, the set of Topical Categories includes

Varieties/Examples (cars)

Varieties/Examples (named automobiles)

- Varieties/Examples (trailers)
- Varieties/Examples (trucks/buses/vans).

Under the heading Varieties/Examples (*car*), we find a long list that includes

- Abandoned vehicle
- American muscle car
- Antique car
- Clown's funny car
- Gas guzzler
- Fleet of vehicles.

IdeaBank also lets the user add personal associations and phrases to Topical Categories or to create their own customized Topical Categories.

The third component of the system, Notepad, allows the two databases to work together efficiently. The user can then focus on productive efforts in selecting alternative lines of thought, maximizing the number of high-quality ideas, and selecting the best ones.

on modules designed for specific creative problem-solving situations. Modules include Strategic Planning, Speech and Presentation, Public Relations, General Problem-solving, and more. Writers can use IdeaFisher's Creative Writing Module to help generate analogies to get past writer's block. In DSS in Action 7.19, we describe IdeaFisher's components and list of some of the Varieties/Examples IdeaFisher presents for the Topical Category *car*.

• CHAPTER HIGHLIGHTS

- People collaborate in their work. Groupware (collaborative computing software) supports group-work.
- Group members may be in the same organization or may span organizations; they may be in the same or in different locations; they may work at the same or at different times.
- When people work in teams, especially when the members are in different locations and may be working at different times, they need to communicate, collaborate, and access a diverse set of information sources in multiple formats.
- Collaborative computing is known by a number of terms, including groupware, group support systems (GSS), and computer-supported cooperative work (CSCW).
- The Internet (Web), intranets, and extranets support decision-making through collaboration tools and access to data, information, and knowledge.
- Internet and Web technology has had a major impact on how we communicate and work.
- An intranet is an internal Internet.
- An extranet links a workgroup, such as an intranet for group members from several different organizations. A common use is for groupware applied to a supply chain involving several organizations using Internet technology.
- Groups and groupwork (teams and teamwork) in organizations are proliferating. Consequently, groupware continues to evolve to support effective groupwork.

- Communication technologies are the foundation on which groupware rests.
- Collaboration is much deeper than communication; it conveys meaning or knowledge; material is actively worked on during collaboration.
- The time/place framework is a convenient way to describe the communication and collaboration patterns of groupwork. Different technologies can support different frameworks.
- People may work together at the same time or at different times, in the same place or in different places.
- Groupware refers to software products that provide collaborative support to groups (including meetings).
- Though meetings can be inefficient and ineffective, most groupwork occurs in meetings.
- Groupware typically contains capabilities for electronic brainstorming, electronic conferencing or meeting, group scheduling, calendaring, planning, conflict resolution, model building, videoconferencing, electronic document sharing, voting, and so on.
- Groupware can support anytime/anyplace groupwork.
- Most groupware allows group members to communicate over the Internet with a Web browser interface.
- There are many benefits (process and task gains) to groupwork, but there are also many dysfunctions (process and task losses).
- A group support system (GSS) is any combination of hardware and software that enhances groupwork.
- Group support systems (GSS) are also known as electronic meeting systems (EMS), computer-supported cooperative work (CSCW) systems, collaborative computing, and groupware.
- GSS attempts to increase process and task gains and reduce process and task losses of groupwork.
- Parallelism and anonymity provide many GSS gains.
- GSS may be considered in terms of the common group activities of information retrieval, information sharing, and information use.
- GSS can be deployed in an electronic decision room environment, in a multipurpose computer lab, or over the Web.
- Web-based groupware is the norm for anytime/anyplace collaboration.
- GSS software may include modules for idea generation (via outlining or brainstorming), idea organization, stakeholder identification, topic commentator, voting, policy formulation, and enterprise analysis.
- GSS same time/same place meetings generally follow a fixed pattern: (1) planning, (2) question posing, (3) brainstorming, (4) idea organization, (5) discussion and idea prioritization, and (6) more idea generation.
- The classroom is a natural setting in which to enhance learning by providing computerized support.
- Distance learning (DL) takes place when learning is performed with tools or technologies designed to overcome the restrictions of same time/same place learning.
- As the economics of education and socioeconomic trends evolve, students are completing their college educations in nontraditional ways.
- Both students and faculty must understand how collaborative technology impacts on how they perform course work.
- Creativity is a complex concept.
- Creativity can be learned and fostered with good managerial techniques and a supportive environment.
- Idea generation (electronic brainstorming) allows participants to generate and share ideas simultaneously and anonymously.
- Creativity-support systems (CSS), essentially GSS, can provide computer support to the creative process.
- Human creativity can be supported with idea generation (electronic brainstorming) systems.
- Creativity software programs use association and "thinking outside the box" to trigger new concepts.

• KEY WORDS

- | | | |
|--|---|---------------------------------|
| • anonymity | • electronic brainstorming | • idea generation |
| • asynchronous | • electronic meeting systems (EMS) | • Internet |
| • collaborative computing | • electronic meeting (e-meeting) | • intranet |
| • computer-supported cooperative work (CSCW) | • enterprise-wide collaboration systems | • nominal group technique (NGT) |
| • courseware | • extranet | • parallelism |
| • creativity | • firewall | • process gain |
| • creativity support system (CSS) | • group support systems (GSS) | • process loss |
| • decision room | • groupthink | • synchronous |
| • Delphi method | • groupware | • virtual corporation |
| • distance learning (DL) | • groupwork | • World Wide Web (Web) |

• QUESTIONS FOR REVIEW

1. List the characteristics of groupwork.
2. List the activities of meetings.
3. What is the primary objective of groupware?
4. List the reasons why communication is so important for collaborative computing.
5. List the differences between collaboration and communication.
6. List the frames and collaborative technologies in the time/place framework of IT communication support.
7. List the reasons why meetings can be ineffective and inefficient. Also, list ways to solve the problems.
8. Define groupware. List its goals.
9. List the benefits (gains) of groupwork.
10. List the dysfunctions (losses) of groupwork.
11. Define a group support system (GSS). List its potential capabilities.
12. Define an electronic meeting system (EMS).
13. What is parallelism? What is anonymity?
14. List the three options for deploying GSS technology and their advantages and disadvantages.
15. List the factors that lead to GSS success.
16. List the important issues involving anytime/anyplace meetings.
17. What is learning?
18. List the features of collaborative computing that can enhance the traditional classroom environment.
19. List the reasons why distance learning is becoming more popular.
20. List the advantages and disadvantages of distance learning.
21. Define creativity and list the ways that GSS (CSS) can enhance creativity.

• QUESTIONS FOR DISCUSSION

1. Explain the differences and similarities among features of the internet, intranets, and extranets.
2. Explain how a group might be noncooperative but need to collaborate.
3. How does groupware attain its primary objective?
4. Describe in detail why communication is so important for collaborative computing.
5. What is nonverbal communication? Explain why it is important in human-to-human interaction. What methods are currently being used to incorporate nonverbal communication into collaborative computing?
6. Explain why collaboration is deeper than communication.
7. Explain why it is useful to describe groupwork in terms of the time/place framework.
8. Describe the kinds of support that groupware can provide.
9. Explain why most groupware is deployed over the Web.
10. Describe and compare each of the groupware packages mentioned in this chapter.
11. Describe the advantages of deploying groupware over the Web.
12. Compare GSS to noncomputerized group decision-making.
13. Explain why meetings can be so inefficient. Given this, explain how effective meetings can be run.
14. Discuss the details of process gains (benefits) of groupwork.
15. Discuss the details of process losses (dysfunctions) of groupwork.
16. Explain how GSS can increase some of the benefits of collaboration and eliminate or reduce some of the losses.
17. Explain how some of the features of GSS have become embedded in computerized productivity tools.
18. The original term for group support system was group decision support system (GDSS). Why was the word "decision" dropped? Does this make sense? Why or why not?
19. Discuss how parallelism and anonymity can produce improvements in group processes.
20. Describe the three technologies through which GSS is deployed. What are the advantages and disadvantages of each?
21. Why are deadlines important for anytime/anyplace meetings? What can happen if they are not set?
22. Explain what factors lead to GSS success.
23. In terms of the advantages and disadvantages of distance learning, explain why some students prefer a distance learning environment and others prefer a traditional learning environment.
24. How have GSS, the Web, and videoconferencing enabled effective distance learning?

25. Explain in detail why companies are moving toward online training.
26. Explain in detail what creativity is.
27. Explain how GSS can support creativity.
28. Explain how idea generation (electronic brainstorming) works.
29. Can computers be creative? Why or why not?

• EXERCISES

1. Make a list of all the communications methods you use during your day (work and personal). Which are the most effective? Which are the least effective? What kind of work or activity does each communications method enable?
2. Investigate the impact of turning off every communication system in a firm (telephone, fax, television, radio, and all computer systems). How effective and efficient would the following types of firms be: airline, bank, insurance company, travel agency, department store, grocery store? What would happen? Do customers expect 100 percent uptime? (When was the last time a major airline's reservation system was down?) How long would it be before each type of firm would not be functioning at all? Investigate what organizations are doing to prevent this situation from occurring.
3. In many nations telephone systems are inadequate, inefficient, or nonexistent, despite the widespread availability of computer systems. What do firms operating in countries under these conditions do to bypass these crippling effects on communication?
4. Investigate body language and report your findings. If possible, use this subject as a presentation topic, actively using body language. How does body language affect the meaning of the message being conveyed? Include in your report how researchers are attempting to incorporate the nonverbal cues of body language into collaborative computing. Also explain how an MIS or CS specialist could incorporate what may be learned from a theater/drama class into his or her professional life.
5. Investigate how researchers are trying to develop collaborative computer systems that portray or display nonverbal communication factors.
6. For each of the following software packages, check the trade literature and the Web for details and explain how computerized collaborative support system capabilities are included: Groove, GroupSystems Online, NetMeeting, WebEx.
7. Investigate methods for improving the effectiveness and efficiency of meetings.
8. From your own experience or from the vendor's information, list all the major capabilities of Lotus Notes and explain how they can be used to support decision-making.
9. Compare Simon's four-phase decision-making model to the GSS-use sequence described in DSS in Focus 7.11.
10. How would you feel about taking a distance learning course that uses courseware (e.g., WebCT Vista or Blackboard) to enhance groupwork and communication with the instructor? Find three (or more) articles in the literature that describe the experiences of students and faculty in a distance learning course and compare your thoughts with their experiences. What advantages and disadvantages does such an approach have?

• GROUP EXERCISES

1. Access the Web Chapter (prenhall.com/turban) on Group Brainstorming and do the exercises.
2. Access the Groove Web site (groove.net). Download the demo software to each group member's computer and use it to brainstorm and vote on a specific problem or issue (note, as of press time, the demo version was fully functional but did not support addins or video). When brainstorming, think broadly. Did you feel comfortable with the software? Why or why not?
3. Access the Web site of a for-lease Web-based groupware service (e.g., WebEx). Describe what features it offers and how they could help the members of a group work together. If the site offers a free trial, have your group try it out and report your experience to the class.
4. Identify colleges and universities that provide courses via distance learning (use both traditional library sources and Web sources). Find at least four articles on the topic. What types of courseware do these institutions use? Are the courseware tools effective when compared with standard teaching methods?
5. Case Study. As part of some recent fieldwork (Dennis and Garfield, 1999), several groups at a hospital met to discuss issues of and develop ideas for strategic planning. Some groups used GSS-supported electronic meetings (reluctantly), while other groups used the traditional meeting approach. Most of the

members who started with the GSS discarded it, realized how much better off they were with it, and went back to it. When the central administration examined suggestions from both sets of groups (traditional

meetings and GSS-supported meetings), it pursued the ideas of the GSS-supported groups almost exclusively. Why do you think this happened? Explain.

• INTERNET EXERCISES

1. How are decisions supported by groupware? Identify software products on the Web that help groups work and make decisions. Download a package, install it, and try it (or if it runs on the Web, just run it). Report your findings to the class.
2. Search the Internet to identify sites that describe methods for improving meetings. Investigate ways that meetings can be made more effective and efficient.
3. Access the Web site of GroupSystems.com (group-systems.com) and identify its current GSS products.
4. Access the Expert Choice Inc. Web site (expertchoice.com).
 - a. Find information about their group support products.
 - b. Team Expert Choice is related to the concept of the AHP described in Chapter 4. Evaluate this product in terms of decision support. Do you think that keypad use provides process gains or process losses? How and why?
5. Identify five real-world GSS success stories at vendor Web sites (use at least three different vendors). Describe them. How did GSS software and methods contribute to the success? What common features do they share? What different features do individual successes have?
6. Access a demo version of a GSS (e.g., Groove, WebEx, or even NetMeeting) on the Web. Use the system for a meeting of your group to solve another group assignment for any of your courses (check with your instructor). Explain why you did or did not feel comfortable with the software.
7. Identify three Web-based courseware systems. Compare and contrast their features. If a "test drive" or demo is available, try it out. Which one do you prefer and why? Report your findings to the class.
8. Go the Creative Think Web site (creativethink.com) with a problem in mind that you are trying to solve (e.g., selecting a graduate school, an undergraduate school, a job). Use the Give Me Another Whack button to enhance your thinking. Try a few of their Whacks to see if they can help you. Did they?
9. For one of the creativity software packages described in the text, go to the company's Web site, download and try out a demo, and describe your experience in a report. Include what you liked and didn't like, and what you found useful and didn't find useful.

• TERM PAPERS

1. Describe the latest developments in collaborative computing/GSS in a term paper.
2. The activities and competence of a group facilitator are critical to the success of a GSS session. Identify recent articles and Web sites on GSS facilitation and write a term paper describing what makes a good facilitator for GSS and how GSS can support the facilitator.
3. Some GSS researchers are concerned with the cross-cultural effects of computer system use. This is especially important in GSS, where opinions are usually entered and synthesized by meeting participants at different places around the globe. Examine the literature and write a term paper on the major issues of how GSS provides either process gains or processes losses in a multicultural electronic meeting setting.



PFIZER'S EFFECTIVE AND SAFE COLLABORATIVE COMPUTING PILL

INTRODUCTION

In the United States, the long, difficult research and development involved in getting a new drug to market often requires an immense collaborative effort. Drug companies must conduct broad, expensive trials before their products even reach the Food and Drug Administration (FDA) for approval. Out of the tens of thousands of compounds discovered each year, only 7 percent make it to market. After an extensive development phase, pharmaceutical companies must back up their drug efficacy claims with mountains of paper (typically more than 1 million pages—equivalent to a tractor trailer full of paper) sent to the FDA, the federal agency that evaluates pharmaceutical products before they are placed on the market. The FDA's approval process is also a long, detailed one.

In addition, drug companies also face added pressure because of a congressionally mandated restructuring of the FDA's review process. The FDA is required to shorten its review process to 12 months from its typical 18-24 months to get drugs to market faster without compromising safety.

To move documentation more swiftly through the FDA's approval procedure, Pfizer developed an electronically based drug submission process, Pfizer's Electronic Submission Navigator (ESUB) is a vast improvement over its old paper-based method of submitting documentation to the FDA. Pfizer's award-winning system cost \$3.2 million to develop and netted the company at least \$142 million in revenues through the start of 2000 because of shorter cycle times. But ESUB has also changed the way that research clinicians and the IT staff collaborate.

"Esub has had enormous impact in that it has transformed the way we do things internally," says George Milne, president of research and development for Pfizer's central research division in Groton, Connecticut. "Our ability to execute new drug filings has been brought to an unprecedented scale," he claims. "It's much more than just an interesting computer system. The tools that Esub gives us will stimulate insight. We expect it to lead to a cascading effect of innovation." Esub has directly impacted the industry and serves as a benchmark for the FDA submission process.

TRUCKLOADS OF PAPER

In mid-1995 Pfizer's researchers were developing Trovan, a new antibiotic drug being readied for FDA approval. The potential new product would be the largest anti-infective submission ever received by the FDA.

Typically, researchers and support staff produced separate sections of a paper document reporting the results of drug trials. Each section was eventually assembled into a master document called a *new drug application* (NDA). Once compiled, the NDA was edited, copied, and sent to the FDA to start the approval process.

The FDA distributed portions of the report to reviewers who wrote their own analyses. Document management, revision control, and cross-reference accuracy were a major challenge. Individual reviewers worked with 20,000-page sections, each a stack 5 or 6 feet high. Cross-referencing caused major headaches. A reviewer who needed to check something on a page outside his or her section had to wait for the FDA to send a runner to copy it from the master version in the library warehouse. The reviewers needed access to the latest version of every section of the document.

To solve this problem, Pfizer's staff used computer-aided NDAs (CANDAs) to build sections of the document electronically. Though they didn't provide all the data and performance was slow, it was the best that current technology could provide in 1995.

At that time the Web was beginning to take off, and Walter Hauck (an associate director in charge of clinical applications development and now director of clinical systems) suggested that the time had come to experiment with it. In April 1996 Hauck and his IT team showed a crude prototype to one of the Trovan clinicians, who in turn showed it to Scott Hopkins, executive director of anti-infectives. Hopkins instantly saw the benefit of the project and gave it the go-ahead.

Pfizer's IT team created about one Esub prototype per week, rewriting the code nearly 40 times until it became easier to manage. During Esub's development, the size of the NDA for Trovan was grossly underestimated. The submission grew to almost 50,000 documents,

Adapted from M. Blodgett, "Prescription Strength," *CIO*, February 1, 2000, pp. 94-98.

close to 180 gigabytes. As the project grew, the prototyping process created excitement among members of the IT team and the clinical team.

ESUB EMERGES

On December 28, 1996, nine months after its conception, Esub was delivered. Because Trovan was so complex in terms of its trials and use, the teams identified and solved tough problems first. In March 1997, Esub handled the submission of Viagra with ease. Now the clinical team can collaborate on new drug applications, with the FDA and its reviewers using Esub to coordinate their work.

ESUB BENEFITS

The benefits of Esub go far beyond a typical return on investment. Esub has become a company-wide collaborative data-sharing system that is also being considered by the FDA as a benchmark for other drug company submissions. Pfizer maintains a competitive advantage in building quality dossiers in real time. Esub has also created a heightened role for IT within the Pfizer organization.

By working collaboratively with its business partners, Pfizer's IT team constructed a system that

- Provides a global view of the status of a trial or application process.
- Enhances Pfizer's competitive advantage by linking drug researchers around the world; Esub has attracted business partners, including other drug manufacturers seeking to forge strategic alliances with Pfizer to help market and distribute their drugs.
- Enables Pfizer to penetrate world markets much more quickly by filing concurrent submissions in different countries.
- Gives the company the ability to deliver five new drugs every 12 months—the fastest rate in the industry.
- Features an electronic table of contents to negotiate the forms of an NDA.
- Allows portable review with a full-featured system—important because the FDA frequently uses outside consultants.

By 2000, the number of users of the system had increased to 2,000 worldwide at both Pfizer and government regulatory agencies. The Esub repository has grown to 5 terabytes, with roughly 1 terabyte of new data added each quarter. The most important Esub benefit is intangible: new, safe, effective drugs that can be offered to patients quickly.

CASE QUESTIONS

1. What kind of collaboration does Pfizer's Esub support?
2. Who are the collaborators?
3. How does Esub support collaboration?
4. What are the benefits of Esub? What possible disadvantages might Esub have?
5. What specific benefits does the FDA obtain from collaborating with Pfizer through Esub?
6. How could Esub function as the heart of an extranet with Pfizer, its regulatory agency (FDA), salespersons, pharmacies, medical researchers, and doctors treating patients?

(AST APPLICATION 1.1

DOW CHEMICAL CREATES THE WORLD'S LARGEST CLASSROOM

THE PROBLEM

In 2000, Dow Chemical fired 61 employees and took lesser disciplinary measures against another 540 for sending offensive e-mail over company servers. Not convinced that simply monitoring future employee e-mail was an appropriate response to the situation, CEO Bill Stavropoulos (now chairman) decided that all 40,000 Dow employees across 70 countries would take six hours of training on workplace respect and responsibility. This comprehensive response to a pervasive workplace problem would be prohibitively expensive for most global organizations. But Dow could deliver the training through a Web-based training system, Learn@dow.now.

THE SOLUTION

Between October 2000 and February 2001, more than 40,000 employees took and passed the course—a two-hour overview and a four-hour class in their native language. Dow saved about \$2.7 million by doing so. Savings included \$162,000 on manual record-keeping of class completions, \$300,000 on classroom facilities and trainers, \$1 million on course handouts, and \$1.2 million in salary savings. Most of these savings were due to shorter training time.

IMPLEMENTATION OF THE SOLUTION AND RESULTS

The learning system also delivered a tremendous payback in mergers and acquisitions. The rapid assimilation of new employees is key to unlocking the value in acquisitions. Manufacturing-site employees joining Dow must complete a three-part operations discipline course. So far, 11,000 employees have completed their course work online in 30 percent of the time normally required in traditional classroom settings. Dow has saved \$2 million in training costs. Learn@dow.now was also the method that 27,000 employees used to complete the environmental health and safety work processes courses, saving \$6 mil-

lion. Safety incidents have declined as a result, even though the Dow workforce has grown by 25 percent.

Dow spent \$1.3 million on the e-learning system. In the first full year of operation, the company estimates the total cost benefits of Learn@dow.now at \$30 million—\$844,279 saved on manual record-keeping, \$3.1 million on training delivery costs, \$5.2 million in reduced class materials, and \$20.8 million on salaries (Web-based training requires 40 percent to 60 percent less time than a traditional classroom environment.)

When launched, Learn@dow.now offered 15 course titles. By the end of its first year, the system delivered 98 course titles and recorded 24,492 course completions. In 2000, the system offered 426 course options with 208,464 completions.

A GLOBAL CLASSROOM

Learn@dow.now has grown quickly and is now one of the most comprehensive Web-based learning tools around. Current courses range from cost accounting and business ethics to chemistry and hazardous materials handling—each one offered in Dutch, English, French, German, Italian, Portuguese, and Spanish (with some available in Chinese, Indonesian, Japanese, and Thai). Most classes require a post-test to determine whether the employee has mastered the subject matter for certification. When an employee finishes a class, a record of completion is automatically transferred to his or her permanent training file in PeopleSoft 7 HRMS.

As for the online respect and responsibility class, the value has gone beyond the several million dollars saved by delivering the information through Learn@dow.now. Senior leadership demonstrated a strong commitment to protect the company's values of respect for people and to take swift and decisive action where those values are compromised. Dow used the best available technology to design and deliver this important information globally.

CASE QUESTIONS

1. Why was it important for senior managers to commit to sensitivity training?
2. Why was an online learning mechanism selected?
3. What other benefits were obtained through the learning system?
4. What benefits did Dow obtain through the learning system?