Technology foundations of the Learning Organization

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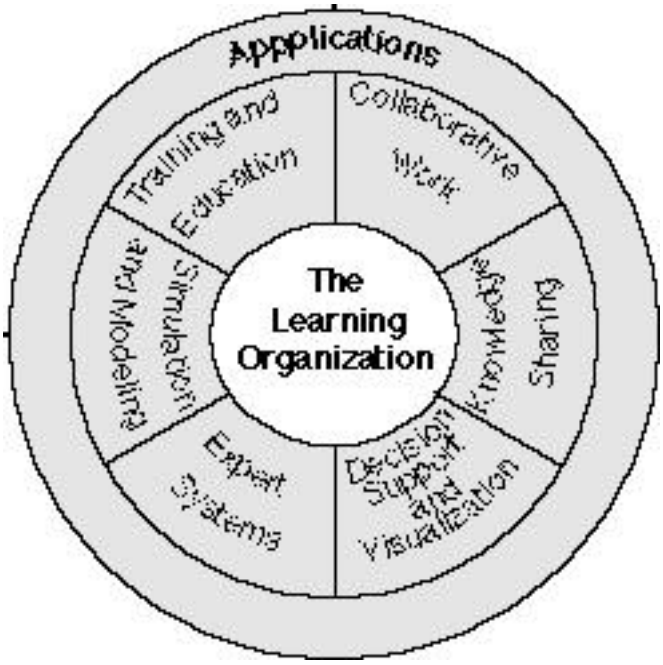
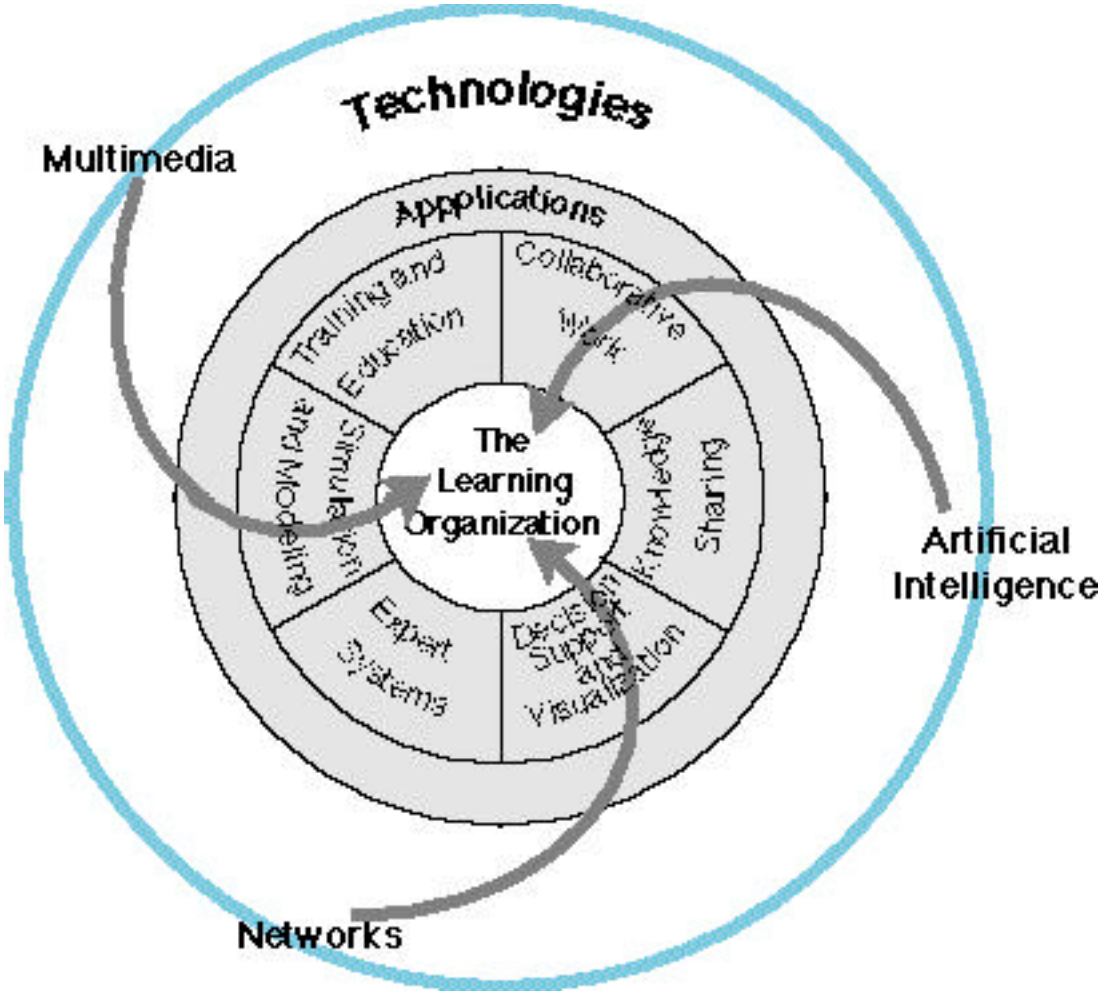
The promise of modern technology to enable the Learning Organization is bounded only by the imagination and creativity of people. Everyday, new and exciting technologies are emerging or are becoming practical and affordable that can have a profound impact on how people capture and obtain knowledge and understanding, and communicate with one another; these are fundamental building blocks of organizational learning.

In this article, we review some of the applications of technology to learning: some prosaic and some exhilerating, but all real and practical. Learning organization applications can be classified into five major categories:



These five applications categories are enabled by three major technology clusters:



By expanding beyond traditional text and graphics displays to the incorporation of motion video, still photographs, sound, and speech, multimedia technologies facilitate the man machine interaction required for learning applications success. Network technologies allow disparate data bases and people to be electronically linked on an as needed, low effort basis. Finally artificial intelligence allows the implementation of intelligent agents and expert systems that package and leverage the expertise of expert and staff with specialized skills and knowledge.

Training and Education

The use of videotapes for training and education has been commonplace for some time, however, videotapes provide a passive experience that is less than ideal for effective learning. As the ancient Chinese proverb teaches:

Tell me, I forget
Show me, I remember
Guide me to do, I understand

Interactive multimedia systems that engage and immerse the student in the experience impart

learning because they go beyong the videotapes ability to show and tell and allow the study to experiment with options, make mistakes, and receive feedback. Motorola's highly automated pager assembly facility in Florida still requires a few highly trained staff despite the automation. Because of the cost of using this three shift expensive capital asset for training, Motorola developed a multimedia based virtual reality training system. This interactive training system has proven itself by reducing training time and reducing the number of mistakes made by the newly trained operators.

Another example of the creative use of advanced training systems is provided by Interactive Video Concepts Incorporated (IVCI). IVCI has developed videodisc based systems for training hospital social workers to assist family members deal with the grief of serious illness or loss of a loved on. The system starts like a conventional videotape presentation and presents the students with a situation not unlike they will face on the job. However, the system moves beyond passive video by pausing at several points into the story and requiring the student to make a choice from a menu of possibilities. The students get immediate feedback about the consequence of a particular action along with comments from the instructor about the wisdom of their menu choice.

Collaborative Work

Groupware is a generic term for a variety of computer and communications-based facilities that enhance the efficiency and effectiveness of people engaged in collaborative work. Organizational learning by definition involves multiple people learning and sharing knowledge in a team setting and any technology that enhances their collabaoration and communication can be thought of as a learning enabler.

By far the most widely used technology in this category is electronic mail (E-mail), which has now achieved a very high level of penetration (e.g. USA Today recently reported that 83% of employees in the US federal government and 62% of employees in the headquarters of Fortune 2000 companies use E-mail), and more recently between corporations (via the Internet, eg.). While electonic mail is frequently used in a straightforward way, for example, in which person A sends a notification to person B (e.g. I will arrive in Brussels on the 8AM flight), or in which one person distributes a notice (e.g. a meeting agenda), it is also frequently used in a more iterative, collaborative manner that promotes learning and sharing of ideas. Here, person A might initiate a thought that is sent via E-mail to a number of other persons, who in turn respond to each other with their thoughts on the same topic. In this manner, ideas can be shared and collaboration achieved (e.g. a joint decision reached) among people in widely differing time zones, and at different management levels in the enterprise (people seem willing to send e-mails to superiors when they would hesitate to send a normal memo or phone message).. MCI, Microsoft, and Apple among others have cultures that are heavily dependent on a huge volume of daily e-mail.

Most e-mail systems also support bulletin boards that promote interchange among many people on a topic. Here messages are sent to the bulletin board rather than the closed set of participants; anyone can then jump in and read from the bulletin board, including gaining access to back "correspondence".

A step beyond the bulletin board is a category of systems that are geared to support collaborative work, the most popular of which is Lotus Notes. Using Notes, many people can share databases of work products (e.g. memos, presentations) and reference material. For example, Chase Manhattan Bank has linked together various internal and external data sources that are easily accessible via Notes; users can then add their own comments or data (e.g. conversations with customers) and make them immediately available to anyone with a PC.

Still another type of groupware is designed to facilitate a team of people in a meeting (either co-located or via video-conference). Each attendee has access to a PC or a specialized input device where they can register their "vote" on a particular topic, and the result appears on the overhead screen. Because the system is computer based, real time analyses can easily be performed, such as calculation of means, medians, and variances, and also correlations (e.g. correlating the answers with the respondent's age or number of years with the company). IBM has made effective use of meeting support software from Ventanna Corporation to conduct idea brainstorming, classification, and voting. Typical experience with these systems is that the time required for such meetings is reduced by up to ten times. In addition to the productivity gain, there are many other benefits:

- Even shy participants get equal access to the contribution process
- The meeting report can be distributed without delay
- The immediate feedback provides comfort that all comments are captured

Knowledge Sharing

An important category of technology applied to learning is knowledge management and sharing systems. Basically the idea is to capture relevant knowledge in a database system and then make it available to others in the organization as needed. Knowledge sharing and knowledge sharing systems differ from data sharing and conventional data base technology in several important respects:

Info System	Query Structure	Access	Information Stored	Output
Data Sharing	Generally structured and difficult to use	Generally limited to a few with specific job needs	• Numbers • Text	• Periodic Reports • AdHoc queries
Knowledge Sharing	Generally unstructured and easy to use	Generally widely available to many who add to as well as extract knowledge	• Data+ multimedia • Images • Sound • Rules • Advice & Expertise • Procedures	• AdHoc+ • Continuous and integrated into the workflow

The knowledge may be internal or external. Internal knowledge would cover just about anything of value to a wide audience, including best practice (i.e. lessons learned), intellegence about customers or competitors, and so on. For example, Toyota has created a database of responses from two customer surveys that it makes available to dealers, salesmen, market researches, and even service personnel. External knowledge might cover R&D reports, economic and industry news, technology trends, etc.

The challenges in sharing and managing knowledge involve collecting it and then making it available in an easy to use form on the desktop. External information is easy to collect as there are many commercial services that will supply information on a regular basis, or allow you to connect into their network to search for some specific knowledge.

Decision Support and Visualization

A large varitey of technology learning applications fall into the category of understanding and decision support systems. Understanding is a key element in the learning process and there are many types of systems aimed at helping individuals and groups reach a higher level of understanding, either of what's happening or is likely to happen, usually to support a decision.

Modern data processing systems frequently produce huge amounts of data. Systems of various kinds have been developed to help people better understand the data, and thereby learn more of what the data may imply. A simple example might be the powerful graphics facilities embeded in modern spreadsheet tools. Another example involves the use of geographic overlays to help in understanding data that have any spatial dimensions; Levi Strauss, Banc One, Arby's, and Kaiser Permanente for instance all use geographic data overlays to better understand their market dynamics.

So-called "data mining" systems capitalize on the evolving ability of information technology (and recently parallel processing data base machines) to help discover meaning and make practical sense out of masses of transaction based data. The most common application is the analysis of point-of-sale data, now captured as a by-product of supermarket optical scanners. Analysis of this hugh volume of data can help help companies learn about their customers and the impact of various promotional campaigns.

Virtual reality technology also has some interesting applications in helping to understand data; investment portfolio analysis for example, frequently involves trying to comprehend relationships among many variables. By viewing this data as three dimensional shapes and actually manipulating the shapes using a "data glove", a greater understanding of relationships among the variables can be achieved.

Another class of systems that is designed to improve understanding is the so-called "management flight simulator" (alternatively called a "microworld"). An outgrowth of industrial dynamics (now called systems dynamics), these simulations are built upon an underlying "mental model" of the dynamic and frequently complex cause and effect, and feedback relationships among actions that management can take in running a business, or that various parties can take in a mutli-party environment. By taking certain actions (e.g. setting investment levels, hiring rates, prices, service levels, etc) and then running the simulation and analyzing the results, a team can learn about cause and effect and the potential consequences of certain actions. The idea isn't so much that the simulation give the "right" answer, but it gives a reasonable answer and forces the group to share assumptions and insights about why that result might be caused by the actions taken.

For example, Innovation Associates, a leader in the learning field and the company with which Peter Senge (The Fifth Discipline) is associated, helped a large power company build a dynamic model of its business. This model attempted to capture the relationships among electricity prices, competitiion, productivity, costs, regulations, revenues, and alternative fuel shifts, so that the potential impact of different marketing programs could be better understood from a varitey of perspectives.

Another use of technology to aid in understanding has to do with the creating of test environments and testing facilities. Testing and experimentation are basic to the learning cycle; simulations can be thought of as a way to test a hypothesis in a simulated environment while test environments provide real, but limited test conditions. Demos, mockups, breadboards, pilots, and models all provide the ability to try something out, learn what might be workable or not, and change design parameters prior to investing huge sums in production versions. Generic facilities that support such testing can be though of as learning tools. For example, The New York Stock Exchange has built a "Usability Testing Lab" to aid in the design of enhanced trading systems. A new feature is quickly mocked-up and demonstrated to trading teams made up of specialists and clerks; as a result the designers and users can jointly learn what is feasible and beneficial in a short time.

Expert Systems

Highly customized and specific systems have been developed to support some aspect of learning. Expert systems that build on AI (Artificial Intellegence) technology are designed to capture the learing of "experts" and make it available to non-experts. For example, Long Island Lighting developed an expert system to capture certain knowledge about the diagnosing of power plant problems by key personnel before they retire from the company (Electrical World, March 1992, "At Lilco, experts may retire, but they leave their brains behind").

One highly successful use of an expert system has been by American Express to detect and manage credit card fraud. This system detects patterns of card use that suggest departure from norms for that cardholder and brings into play the manual intervention of a customer service representative to validate the cardholder and the transaction. With the growth in electronic commerce and wireless communications, the use of this technology for fraud management can be expected to increase.

Another specialized system is in use at GM to support QFD (Quality Function Deployment). The advanaced engineering and manufacturing organizations along with product program managers use the inquiry system to reduce the discrepancy between market information and design specifications. The data is collected by market research.

Summary

Until just recently technology has not been able to support the demands of the learning organization applications. However, we have crossed the threshold in computing system capabilities and performance to unlock the power of these applications. Those firms that rapidly and effectively implement these applications will gain benefits that can lead to importance competitive advantage:

- A more productive work force that does more work in less time
- A highly quality work product that has fewer mistakes
- A higher grade of customer service leading to customer satisfaction and retention
- A higher quality of work life leading to more satisfied, long term employees
- A means to improve compliance with company procedures and guidelines