American Business Review

Volume 18 Article 2

6-2000

Knowledge Management: A Cognitive Perspective on Business and Education

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INTRODUCTION[1]

The concept of knowledge management concerns the creation of structures which combine the most advanced elements of technological resources and the indispensable input of human response and decision-making. While knowledge management is generally discussed within the parameters of the business world, its implications for educational resource questions are equally relevant. With technology in a constant state of change, a rational course of action for the field of education is to look to the business environment for guidance in making use of this technology. Businesses and other organizations have much to gain from improvements in the educational use of computer technology, from elementary grades through the university level.

This paper reviews key principles for creating and maintaining the knowledge base, and resources for teaching and learning. The discussion will cover the clarification and definition of several terms including information, knowledge, data, and filtering. Various elements of knowledge management in the business environment are addressed by discussing the sources that present them, and, where relevant, are applied to the education context.

KEY ISSUES AND OBJECTIVES IN KNOWLEDGE MANAGEMENT

The main issue with knowledge management is where executives get the insight they need to run their business and how they formalize that insight. Making use of diverse and changing resources has two main objectives. One, in order to substantially benefit from the available technology in the classroom or other educational setting, the resource material to be presented and manipulated must be available. The educator should be able to efficiently, if not easily, locate and access the needed resources in a timely manner. So to begin with there is the goal of providing the library of information and materials, or 'knowledge'. This array of knowledge is by no means static, so maintenance of the system, involving reorganization procedures and continual development of information sources, is necessary.

The other essential objective relies more on the human capabilities of analysis and decision-making. The knowledge base must be combined with the ability to effectively and efficiently filter the tremendous amount of data and information so that what is left is truly meaningful packets of knowledge. Software and machines can accomplish this to a point, but the human input and control in the system is the critical component. This, too, should be a continuous and ongoing process, both for the education and business arena. The intent here is not to examine the technical aspects, but to consider the cognitive process needed to develop a useful framework in which to manage our store of knowledge.

The various discussions of knowledge management revolve around the technology issues or the human issues. Both are critical ingredients of any solution, converging where the solution leverages the information stored in people's minds—tacit knowl-

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edge—and the information stored as hard data—static knowledge. From the technology standpoint, software products to service and facilitate the knowledge management objectives such as text search and retrieval engines, software that organizes knowledge into hierarchies, collaborative/groupware software, data mining, and interviewing software are still in relatively early stages of development. This element, however, is of secondary importance to the human element. To arrive at a stepping-off point for this article, the end-user perspective is used, which identifies cultural issues as the largest obstacle to implementing knowledge management (Hibbard and Carillo, 1998; Davenport and Prusak, 1998). Regardless of the technological solutions being sought, the changes, adjustments, and understandings required of both business and education users represent the subject of this paper.

KNOWLEDGE VS. INFORMATION

The information environment that we live in has and is undergoing extreme change given the variety and sheer volume of data that is readily available. This volatility, a natural outcome of our growing and changing technology, requires a re-examination of how we look at and process resources (Hibbard, 1997). Dataquest predicts that by the year 2000 companies will be spending more than $5 billion globally for knowledge management services such as systems integration, consulting, and outsourcing, compared to just $1.5 billion in 1996 and $900 million in 1995.

A keystone to understanding how to approach this vast ocean of data, which seems to come at us from all directions, is the distinction between 'information' and 'knowledge' (Breen, 1997). As stated by Peter F. Drucker, "We now know that the source of wealth is something specifically human: knowledge. If we apply knowledge to tasks we already know how to do, we call it productivity. If we apply knowledge to tasks that are new and different, we call it innovation. Only knowledge allows us to achieve those two goals."

Information, in all its forms and packages, cannot necessarily be considered a useful part of the knowledge base that businesses desire. It is often easy to mistake flashy gimmicks and trappings as part of our knowledge wealth, and consequently risk a waste of time and energy due to a lack of, or a gap in, the process of verifying, transforming, or discarding the many inputs to an information system. This filtering process itself may be a technical procedure, a human action, or a combination of both. Information, then, is considered raw data and appears in many forms from many sources. It may be anything from cryptic lists of coded data arriving from a database somewhere, to simply unverified responses off of the Internet. Information can become knowledge either through some transformation process that makes it useful, or a discernment process that discovers its usefulness. Thus it is believed that data are raw facts, that information is formatted data, and that knowledge is formatted information.

LITERATURE REVIEW AND SYNTHESIS

The intent of the literature search was to find a significant link, of a technological nature, between the education process and the business arena. This was motivated by an interest in what possibilities the future holds for educational technology, and with the assumption that advances in technology are currently and will continue to be a major driving force of change and development in education. One assumption quickly confirmed was that the largest sector of education, the elementary through high school levels, are significantly lagging in facilities, equipment, and implementation policies. Trade schools, commercial training programs, university programs, and in-house corporate programs are equipped at a much closer level to the requirements of current practices. A commonly held view among secondary education, higher education, trade schools, and business sources is that the management and use of technological resources is applicable and necessary at all levels of education and business. Most discussions of technology education included consistent references, in one form or another, to the concept of *knowledge management*. Sources focusing on the secondary and university level expanded the importance of the use of this technology to all areas of education, and either implied or clearly stated that the structure of education will be significantly altered in the near future. Since knowledge management is a practice and new knowledge is continually added and refined, the final destination (i.e., project completion) is a constantly moving target. This necessitates a changing pedagogy that encompasses intelligent agents for search and retrieval, collaborative workflow management, knowledge maps, document management and so forth. The changing pedagogy and content act as antecedents to a new era of epistemology that requires holistic rethinking of educational needs. For instance in electronic commerce which is an important part of the knowledge management puzzle, it is sometimes more important to find answers to questions such as why a customer bought a product/service than who bought what and when (Goodman, 1999). Consider the boost to an organization's future sales if its product development and marketing departments were able to augment their own expertise with the combined knowledge of their customers, salespeople, customer service people, and maintenance people.

The literature found to be useful can be organized into four categories: 1) defining knowledge management, 2) rationale and implementation for knowledge management, 3) educational needs resulting from

knowledge management, and 4) the use of technology in education.

The definitions of knowledge management range from narrow, utilitarian views to much more conceptual and broad perceptions. Definitional elements pertinent to the education perspective include the distinction between information and knowledge, and the procedural aspects of this resource. Understanding the difference between information and knowledge, and how to transform one to the other, answers the question of what a knowledge base can be. A complete definition, however, also includes the connection between the system and the users, or just how the system is used in a given environment. An organization's intellectual capital, as some authors refer to it, is the complex and ever-changing mix of information resources and the workers themselves. "To conceive of knowledge as a collection of information seems to rob the concept of all of its life...Knowledge resides in the user and not in the collection. It is how the user reacts to a collection of information that matters" (Churchman, 1971; www.brint.com).

The definition of knowledge management appears in numerous variations but a common thread does seem apparent. Knowledge management is commonly defined as an attempt to put processes in place that capture and reuse an organization's knowledge so it can be used to generate revenue. "By definition, knowledge management is an attempt to contain a massive amount of information, organize it logically, and make it accessible to the right people, on time" (Dunn, ed., 1997). A definition more specific to a business organization may be more concise, "the process of capturing a company's collective expertise" (Hibbard, 1997). This collective expertise of a particular organization is only one part of a more general definition, which also includes any source of useful data which can be accessed, such as the Internet, and used in the regular workings of that organization (Davenport, 1997). A process-oriented definition looks at the policies and practices that facilitate the implementation of knowledge management. "Knowledge management is a way of doing business" (Angus, Patel, and Harty, 1998). Knowledge management caters to the critical issues of organizational adoption, survival, and competence in face of increasingly discontinuous environmental change. Essentially, it embodies organizational processes that seek synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings (Malhotra, 1998).

A rationale for knowledge management and its implementation are often discussed together in the chosen literature. Productive utilization is the reason for the existence of any technology, so providing a rationale without the capability of practical implementation is not convincing to the audience of these sources. That the need for knowledge management is technology driven is a commonly expressed view. The glut of information produced and distributed so effectively by technology must be received, organized, filtered, re-packaged, distributed, and recycled. Individuals and organizations are motivated by either the desire to take advantage of greater resources, or the fear of significant loss and waste from not being able to efficiently use available resources. Technological solutions to these needs are in the beginning stages and the applicable parameters impacting the solutions are still being discovered. Of more interest to this paper are the human considerations for implementation. "As human beings we distinguish ourselves from other life by generating and applying knowledge...Self discovery is a powerful way to assimilate and appreciate new knowledge" (Dove, 1998).

The educational needs which result from addressing knowledge management simply comprise the second basic step of the process. Identifying the need is first. To proceed with analysis, decision, and implementation, training and education are needed at every step. Formal response to this need at the business level may be in workshops, in-house training programs, or other forms of continuing education. Less formal responses reside in the implementation and policy decisions made along the way. This is still, fundamentally, business as usual. In the education arena, however, since technology is still laboring to break through in a much more significant way, the implications of knowledge management technology can be universal and dramatic (Bennett,1996).

With the related category of technology in schools, the focus is somewhat more mundane. Nevertheless, for educational decision-makers to move from the status quo of current technology use to beginning the path to what the future can hold, something more than just new technology must be addressed. New ways of thinking, a paradigm shift, perhaps, go hand in hand with the literature's discussion of education and technology. The pervasive view is that current policies and procedures in education may not be capable of harnessing the possibilities of available resources. The knowledge management concept, which has the capability of reinventing itself to some degree, may be what is needed for what ails education (Perronne, et al., 1997).

THE ELEMENTS OF KNOWLEDGE MANAGEMENT

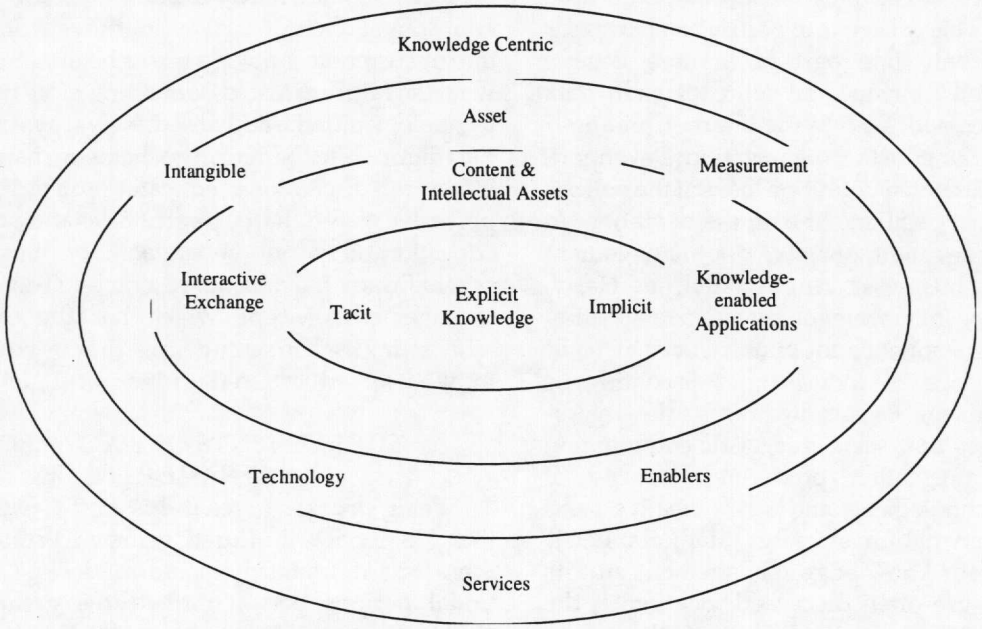
Peter Drucker notes in his *Post-Capitalist Society* that "Every few hundred years in Western history there occurs a sharp transformation..." The transitional periods between the three great waves of change (i.e., agricultural age, industrial age, and information age) are marked by tremendous societal and economic upheaval. Hope and Hope (1997) use

Tofler's (author of *"The Third Wave"*) typology to describe the changing nature of competition in the industrial and post-industrial era and suggest a paradigmatic change in thinking outside the box that is necessary for managers to succeed in the information era. The third wave economy places capital in a secondary role, and knowledge becomes the source of wealth creation. The Hope brothers contend that society is currently in the dislocation phase between the second and third wave economies and the fault lines between the second and third wave economies are momentarily blurred. The organization's strategy will need to be aligned with third wave realities in order to succeed in the third wave.

The objectives of a knowledge management program will vary in some details from organization to organization, but how successfully knowledge is acquired and deployed in an organization and the human elements discussed here will be instrumental to any program's success and a critical source of competitive advantage. Figure 1 illustrates the product and service domain of knowledge management. The development of the technology to create and maintain a knowledge base can only be as effective as the decision-making that goes into it. "Managers who are ready to take the plunge into knowledge management will find it's more about changing business processes than about upgrading software" (Hibbard and Carrillo, 1998). The collaboration of all members of the organization is needed to fully take advantage of this endeavor. This process must be entered into with a plan of action that incorporates all users. It may appear to some that simply providing the technology and allowing access to the available resources will result in an effective library of knowledge. Organizations that are eager to "harness their intellectual capital" may follow this route without taking the time to consider and take care of the essential elements and processes (Myers and Swanborg, 1998).

The data is already out there in abundance and steps need to be taken to process and filter it to the specific current and projected needs of those who will use it. With the technology available to us today, too much information and unusable information are just as debilitating as a lack of information and resources. In the education arena, this problem may manifest itself when a school obtains computer equipment, including access to the Internet, without an adequate plan to create a useful structure for in-house use by both teachers and students. "Surfing the Web is still largely a passive consumption activity" (Perronne et al 1997). Children and adults need structure, and even with the tremendous wealth of varied resources that the Internet provides, equally tremendous time and energy resources can be lost without realizing it. "The Internet can and will be a valuable tool in education...Nonetheless, the Internet, by itself, will not provide the educational revolution needed today" (Bennett, 1996). The business environment is not

FIGURE 1
Knowledge Management
Product and Service Domain



Source: Yankee Group

immune to the same type of production loss for the same reasons, and possibly due to poor planning and structure of the knowledge core. Large amounts of material can easily end up on servers for no real knowledge-sharing reason (Davenport, 1997).

The next pitfall to consider is perhaps more illusive than most, as it has to do with semantics and a cultural sensitivity. The simple use of the term 'knowledge' can have adverse effects on the overall reception of a knowledge base by the potential users. In a school setting, the term has a more natural fit to the environment, though negatives still exist through peer pressure of popularity games with students. Strangely enough, however, a "peer pressure" of a sort can also develop in a given work environment, especially if other buzz words such as 'best practices' or other labels are used. The difficulty here is that labels begin to fail to describe what they are intended to represent, and a dilution effect can take place (Davenport, 1997). This would not seem to be of great significance, depending upon the individual scenario.

Of somewhat more significance is the question of incentives for employees to contribute fully by sharing their knowledge. This collaboration issue can have a significant impact on the capture and sharing of knowledge within the organization. When the 'hoarding of knowledge' has become a natural mode of operation and it is perceived by employees to help sustain their value to the firm, resistance to changing this habit is natural and difficult to influence. A solution would likely include major changes in some policies and business practices to help facilitate this element, such as the opportunity to work with talented peers, do interesting work which affects customers, develop their talents and skills, share in equity rewards, and customize one's work style outside the bounds of the traditional workweek. Besides institutional moves, "Workers must be reassured that they will still be valued after they give up their know-how" (Hibbard and Carrillo, 1998). This scenario does indicate how extensive some changes may need to be in the attempt to create and make adequate use of the knowledge capital.

The same obstacle shows up in a different way in an education setting. In the move to make more complete use of computing and collaborative knowledge, more tasks will be taken away from the teacher and passed on to the computer. Though computers have been in many schools for quite some time now, the technology is grossly under-used. One of the strongest obstacles to a move as drastic as this example might suggest is a natural fear of the teacher of losing one's usefulness (Bennett,1996). Though the education field is probably not close to such a major change at this point, the factors that can affect some aspects of technology can be as real and significant as this description even now.

One more pitfall to discuss is the failure of management to see the need to provide the specialist function to manage and coordinate the components of a knowledge base. Since all users are, in effect, contributors as well, it might seem that the whole process can be self-maintained. Davenport (1997) brings up the myth that since "knowledge management is everybody's job", then it is reasonable to expect this task to be well in hand. However, even for not so large organizations, such a system requires considerable attention. "Knowledge management will not succeed if there are no workers and managers whose primary duties involve gathering and editing knowledge from those who have it, paving the way for the operation of knowledge networks, and setting up and managing knowledge technology infrastructures" (Davenport, 1997).

The same principle of expert support for information technology applies to schools as well, and not just colleges. Another significant reason that so many schools do not take close to full advantage of computing power is the lack of enough technical support positions. The same forces are at work, though perhaps on a smaller scale than most businesses. Also, the effects are typically invisible, since what is not there in the first place is not easily missed. Evidence of this is seen in the "discrepancies in the knowledge teachers have about technology and networks, which is a real and very serious issue" (Perronne, et al, 1997).

Business organizations coming around to implementing workable solutions and adequate support staff for successful knowledge management is not unexpected nor unrealistic. The costs and benefits of new enterprises are part of what successful organizations deal with in the course of their day. With schools, however, the challenge is much greater. Change takes place very slowly. The components involved in knowledge management perhaps show some hope. These are the very same components needed for the education system to make a real move into the real use of technology in schools. The elements required to create and use a managed knowledge system may provide a path for schools to begin reaching for the potential that computer technology can provide. "By expanding our view of computer as tool to computer as medium that facilitates communication and sharing, we can fundamentally change the way we think and learn" (Perronne, et al, 1997).

With the significant investment in the infrastructure, manpower, and organizational climate adjustments, it is natural to question if the benefits outweigh the costs. Can physical and intellectual capital be separated out from one another and measured? Probably not, but perhaps inferences can be made. Some assumptions would have to be accepted.

"Clearly intellectual capital is the fundamental input to all wealth-generating processes. Without knowledge, natural resources could not be developed, and most of the value of manufactured goods consists in their knowledge contents" (Nasseri, 1996).

The concept of leveraging a company's intellectual capital is being approached with the development of knowledge management practices. A formula for quantifying the intellectual benefits of this movement may not exist, but perceptive leadership skills do exist for recognizing real payoffs even with implementation of this type of policy. In fact, much of the day to day strategic decision-making involves strong consideration of just this asset. The list would include: incentives and corporate culture decisions, establishing company-wide relationships with external providers and contacts, what R & D programs are right for this organization, how to safeguard existing intellectual capital, and what learning systems are needed for the environment and for human capital renewal (Nasseri, 1996).

Knowledge management systems may be paving the way for more organizations to give attention and effort to gain a better understanding of this subject. Skandia of Sweden, the Imperial Bank of Commerce in Canada, and Hughes Space and Communications are among a few companies that are actively pursuing such a strategy. These efforts include establishing a chief knowledge officer and working on ways to measure and enhance the value of their company's intellectual capital (Nassare, 1996).

Applying this same concept to education, again a little more hope is given to the idea of a more aggressive move to technology. Perhaps the most immovable obstacle is the financial decision that would have to be made to provide more computer facilities. Though many computers are already in the schools, considerable upgrades would be required to provide students with adequate access to current resources. One cost estimate is about $400 per student per year over the first six years. Additionally, various savings would be achieved with such a drastic change in the structure of school operations. "The cost of converting American education to computerized education is not large under any system of accounting that considers what the present system is costing the nation. In addition, however, actual dollar savings will reduce these initial costs appreciably and will eventually generate true savings over present practices. In summation, the goal of establishing computerized education is not primarily to save money. Nonetheless, that will be an important result" (Bennett, 1996).

THE LINK BETWEEN ACADEMIA AND INDUSTRY

Despite the apparent differences between business and education which might affect the applicability of business experience with knowledge management (i.e., education's lack of agreed outcome measurements, the absence of competition in any analogous sense to business, the presence of more than 80% unionization in education compared to around 10% in business), a connection is being established between educators and business leaders, as programs are being started throughout the country to establish connections between what students learn in classrooms and their preparation for subsequent careers (including the fast-track knowledge management career). One of the underlying foundations of knowledge management practice is labeling information in ways that allow people who need it to find it, and that requires professionals (e.g., knowledge academicians, theorists and visionaries) who are skilled in building taxonomies and categories. In addition, knowledge academicians can develop and test models and applications, and visionaries can stimulate an organization's thinking by being thought leaders who are frequently well in front of practice and outstanding speakers.

Business needs graduates who can combine technical, business and social skills, and education needs an active connectivity with the current state of knowledge management in industry. The vast resources being created and distributed through the concept of knowledge management may provide the setting in which this connectivity can thrive. For instance, knowledge management professionals in industry have expertise in implementation and are involved in all phases of innovation (knowledge creation, knowledge acquisition, knowledge sharing, knowledge conversion and knowledge commercialization). Their academic and/or career background could be from a variety of functional areas, including finance, human resources, quality, information technology, research and development, manufacturing, sales or customer service. Knowledge transfer between departments is the key to improving core business processes. Cross-functional skills required in business are also being taught in classrooms by using case studies, team projects, research papers, etc. with a cross-disciplinary focus.

Although the technology and the delivery system are very important, the human ability to decide what information to select and use is the crucial ingredient in the efficient and effective use of technology, whether in academia or industry. Advancements in computer technology, especially in data communication (e.g., the Internet, fiber optic/satellite communications), act as catalysts for everyone with access to function effectively in the changing environment. The method in which each generation is educated must reflect how society functions from day to day. Distance learning is a case in point. It is not enough to

simply place the technology in the hands of educators and expect the schools and quality of education to improve. Educators must be educated in the use of these technology resources for distance learning or traditional delivery in a face-to-face classroom setting in the same way as the knowledge management professionals in the business sector. This implies that the educators have to retool and change to proactively prepare for the knowledge economy even before they have had a chance to adequately respond to the criticism of how well they were dealing with the knowledge management challenges in the pre-information age. There is a certain immeasurable amount of creativity and intuition involved in making the leap by breaking the rules, thinking differently and outsmarting their peers with innovative teaching and research productivity, but business intelligence is still the critical tool that allows it to happen. A lesson from industry that educators can apply to their own situation is of the time when Amazon.com entered the book market. Its executives did not try to figure out how to run a better bookstore than the competition; instead, they tried to figure out how to do what the rest of the competition was not doing, i.e., selling books online in a direct, personalized, and collaboratively filtered manner that customers found appealing.

CONCLUSION

The concept of knowledge management suggests the creation of structures which combine the most advanced elements of technological resources and the indispensable input of human response and decision-making. The mix is intriguing and the challenge of managing the complex structure has tremendous potential from either the practical, productive viewpoint, or the human growth perspective. In a way, the development of a 'knowledge entity' seems to be much like the education of a child or a worker. Both have growing, changing, and unpredictable potential for innovation, each in their own way.

"The management of knowledge is emerging as the central theme in business today. We are beginning to realize that its application is the distinguishing factor among companies—but we don't know how to measure it or display it on the balance sheet. Nor do we know how to capture and package it so that we can spread it freely among employees. Nevertheless we know that it is what core competency is all about, and it is what competition is all about—for it is what the business is based upon" (Dove, 1998).

The above statement can be applied to the field of education as it enters more fully into the technological advances available to society. The ability of both businesses and educational entities to embrace the concept of knowledge management will impact the very nature of how society operates. As the field of education searches, discovers, and takes the leap to implement new possibilities presented by advancing technology, the impact will be widespread. "American education is at a crucial juncture...schools must prepare all young people with a new set of skills and understandings to assure the nation's economic competitiveness" -- U.S. Congress, Office of Technology Assessment (Bennett, 1996). Companies seeking knowledge management solutions are usually driven by a need for innovation. Continuous learning is an absolute necessity, as up-to-date knowledge becomes the currency of the realm. In order to transform intellectual assets into business value, firms need to exploit their knowledge by strong collaboration with its internal and external community (since knowledge is dispersed throughout the organization), develop a supportive atmosphere of openness and trust in order to effectively leverage their workers' knowledge for competitive advantage, and develop business processes that can take advantage of the information technology architecture.

NOTE

[1] *"The only irreplaceable capital an organization possesses is the knowledge and ability of its people. The productivity of that capital depends on how effectively people share their competence with those who can use it."*

—Andrew Carnegie

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