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Trend Analysis:

Knowledge Management Systems and the Implications for Instruction

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Abstract

Knowledge management covers the generation, codification, and transfer of knowledge. Two important advancements have helped KM systems become useful tools in instructional design. (1) interfaces have improved to empower the user and (2) learners are becoming more involved in the process of gathering, cataloging, and transforming tacit knowledge into explicit knowledge. There is every indication that the discipline of KM will continue to grow significantly in the future. The major impacts of KM on instructional design can be broken into three major sections: generating value from sharing information, linking users into a community of shared knowledge, and the evolution of the role of instructional designers. These impacts have led to definite benefits including improved collaboration among team members, efficiency and long-term productivity, and ease in the re-purposing of information. Risk factors include the need for buy-in from users, the requirement that expectations are set, trust in the information, and the need to evaluate the knowledge management tools.

Knowledge Management Systems and the Implications for Instruction

"...for thousands of years, humans have been discussing the meaning of knowledge, what it is to know something, and how people can generate and share new knowledge." - Knowledge Management Tools, Rudy L. Ruggles, III, 1997

Description

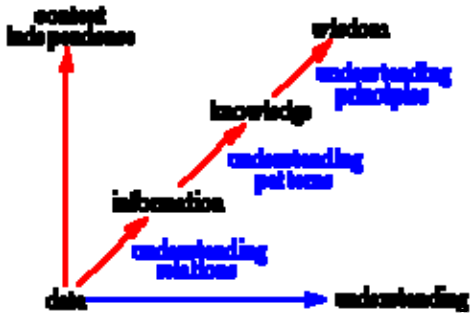
Knowledge is a fluid mix of contextual information, values, experiences, and rules. It comes in many forms, including process knowledge (how-to), catalog knowledge (what is), and experiential knowledge (what was) (Ruggles 1997). According to Ruggles, knowledge management (KM) covers three main knowledge activities: generation, codification, and transfer. Knowledge generation includes knowledge creation, synthesis, acquisition, adaption, etc.; any activity that generates new knowledge. Codification refers to the capture and representation of knowledge in a way that it is reusable. Tranfer is the process of movement of the knowledge from one repository or place to another and the eventual absorption (Ruggles 1997).

Two definitions are central to the understanding of knowledge management: explicit knowledge and tacit knowledge (Clark 1999). Explicit knowledge can be expressed in words and numbers and shared in the form of data, scientific formulas, product specifications, manuals, etc. This type of knowledge can be transmitted across individuals formally and systematically and can easily be processed by a computer, transmitted electronically, or stored in databases. Tacit knowledge is personal and includes subjective insights, intuitions and gut instincts. Tacit knowledge is rooted in experience and, due to its subjective and intuitive nature, it’s difficult to process or transmit the acquired knowledge in any systematic or logical manner. Tacit

knowledge must be converted into words, models, or numbers in order to be communicated. Knowledge management systems are concerned with both types of knowledge transfer, but the importance of retention and transfer of tacit knowledge is a strong focus of the KM and education communities.

For years, the focal point of the KM community has been the business application of KM, and, most recently, the development of the learning organization. KM practitioners focused primarily on transforming data into information, knowledge, and ultimately wisdom.

Figure 1. Data to wisdom continuum (Igonor 2002)



Whereas *data management and information management tools* (e.g. automated research and retrieval agents, decision support technologies and document management technologies) allow us to access, warehouse, manipulate and analyze data, *knowledge management tools* assist in the process of knowledge generation, codification and transfer. Ruggles discusses how these tools (usually technology-based in the case of knowledge management) are necessary for information and knowledge to be applied effectively (Ruggles 1997).

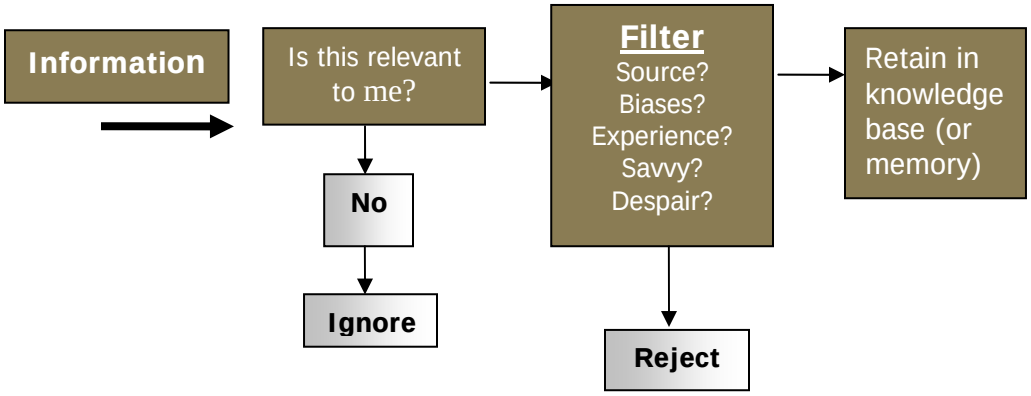
So, where does the discipline of knowledge management fit within the learning community, in instructional design, and in e-learning? Barron, addressing the role of KM in e-

learning, indicates that e-learning should manage knowledge, filter knowledge and deliver it to the right audience (Igonor 2002).

> Take an e-learning course. Chunk it into discrete learning bites. Surround it with technology that assesses a learner's needs and delivers the appropriate learning nuggets. Add collaborative tools that allow learners to share information. What do you get? Something that looks a whole lot like knowledge management (Barron 2001).

According to GodBout, the traditional knowledge filtering process looks like the following:

Figure 2. Filtering of information (Godbout 1999)



KM visionaries propose that in the future, knowledge management will change that filtering paradigm whereby knowledge management systems will be a variety of tools that will draw upon a collection of reusable learning objects and that these tools will support instructional design and learning environments (Spector 2002). Woelk and Agarwal provide a scenario of how knowledge management might play out in an e-learning environment with the intervention of instructional design. In this scenario, a knowledge organizer (who may or may not be the instructional designer) organizes from knowledge created from holders in a knowledge repository. The instructional designer further organizes or structures the knowledge by adding pre-assessments, additional learning aids, and post assessments. The learner then learns the explicit knowledge through a guided learning experience. Ideally, the performance of the learner

is measured and returned to the knowledge repository as feedback, to suggest further learning experiences (Woelk, Agarwal 2002).

The integration of knowledge management and instructional design and learning environments has the potential to grow considerably in the future. Experts predict that in the future, knowledge management systems will integrate with educational technology and the way instructional design teams work (Spector 2002). Many see a strong need for these systems in collaborative work and, in fact, some see enhanced socialization and interaction as being integral to the integrated knowledge management/instructional design models of the future (Woelk, Agarwal 2002).

Analysis of Underlying Causes, History, and Related Issues

Programmers and software engineers developed the first knowledge management information systems as project management tools. These systems became increasingly necessary as software development projects became more complex and required teams of designers. The key features of the systems were the ability to communicate, coordinate, collaborate on, and control large-scale research and design projects (Spector 2002).

Engineers found the systems to be particularly useful for two types of iterative prototyping development: rapid application development and dynamic systems development (Plass & Salisbury 2002). Both types of project management focus on projects that are time sensitive, balancing cost and quality with time as effectively as possible. The steps involved include:

1. Perform feasibility and business studies
2. Begin iterative prototyping to build a functional model
3. Designing and building quality systems that can be implemented
4. Implementing the system

(GamCom Solutions 2003)

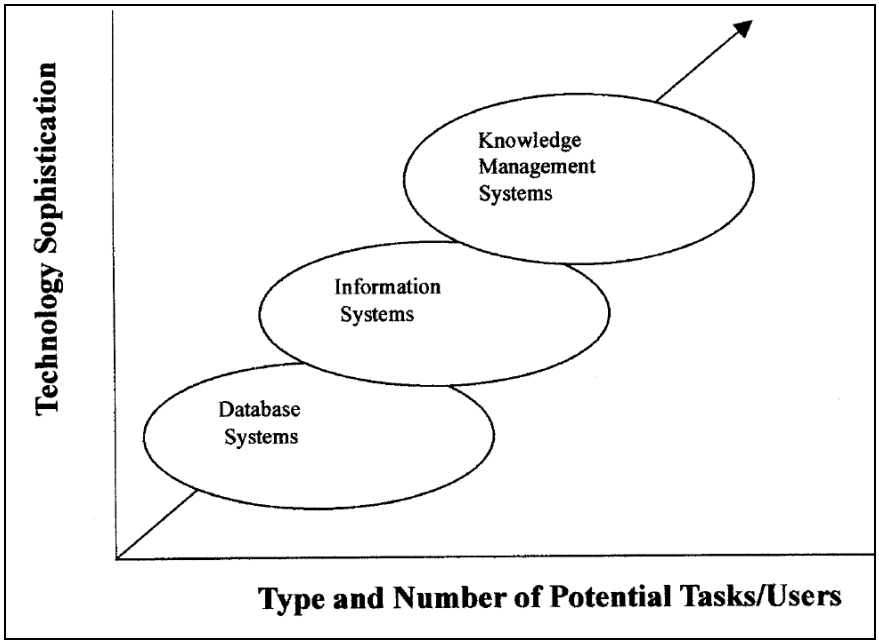
These iterative prototyping steps are driven by the system requirements. Communication between stakeholders and within the development team is crucial to ensuring all of the requirements are met. Knowledge management systems facilitate this communication and provide the structure to control and the flexibility to change the system both during and after the formal development process is completed.

There have been two important advancements in knowledge management systems that have helped them become useful tools in instructional design. The knowledge management systems initially employed by software engineers and programmers were developed as computer-oriented interfaces, which made sense for the original audience. Over time, as computer programming has changed and more non-technical end-users play an increased role in developing customized systems, the interface has changed to empower users (Spector 2002). This increased accessibility has made it easier to integrate and deploy amongst instructional designers with a range of technical skills, and allowed the systems to be customized to meet specific learning and business requirements.

With better user-interfaces, it is possible to involve learners in the process of gathering, cataloging, and transforming tacit knowledge into explicit knowledge. Since the systems can change both during development and over the lifetime of the system, and can be changed by users and not just KM system designers, they are able to accommodate and evolve with changing conditions (and audiences). This is another key difference between KM systems and databases and information systems (see Figure 4). These evolving systems “grow and learn through interaction” (Plass & Salisbury 2002). As the technologies become more sophisticated, they can manage a larger number of tasks across a wider range of users, storing and developing

knowledge to meet changing organizational needs. Increasingly, all types of organizations are recognizing the value in these systems and are investing significant amounts of capital to adopt KM technologies.

Figure 3. Evolution of knowledge management systems (Spector 2002)



According to Knowledge Management Magazine (Dyer 2000), the early adopters of KM systems were professional and business services companies in the late 1990's. US spending on KM systems was $776 million in 1998; current estimates and projects put spending today at over $600 billion in public K-12 and higher education and over $70 billion for annual corporate and government training (Malhatra 2005). Clearly, the adoption trend for KM systems in educational settings is established and accelerating. Although the business case for KM systems is strong, implementing them involve significant investments and some risk.

Systemic Impact, consequences, costs/benefits and risks

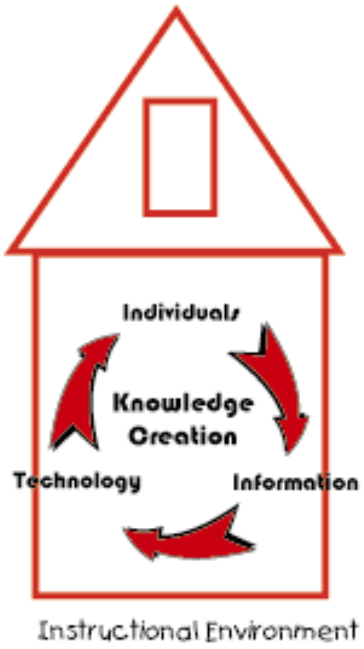
Spector (2002) describes a knowledge management system as "an integrated collection of tools." Critical features of a knowledge management system include support for communication, coordination, collaboration and control. In many settings, instructional designers are increasingly working on projects in virtual teams, Knowledge management tools are a logical solution to facilitating the efficient communication and collaboration among team members, especially in these scenarios.

According to Tobin (2005), there is a systematic approach to successfully implementing knowledge management. You must analyze what you are trying to accomplish, map out a strategy, gain support from the organization and be able to measure your outcomes, to ensure the likelihood of success. For the successful implementation of the knowledge management system, the initiative must be planned to include long-term goals, and be "top-down motivated", for example to "improve customer service or employee satisfaction" (Tobin, 2005). Once the knowledge management system is built and implemented, it becomes an ongoing initiative that requires maintenance. It is not a single outlay of resources and effort, but an evolving system that requires further investments of resources, including time, energy and finances. By approaching a knowledge management system from this strategic initiative viewpoint, the long-range goals should lead to a "collaborative knowledge sharing organization" (Tobin, 2005).

Utilizing a knowledge management system means the role of the instructional design technologist will evolve from one of training and improving human performance, to being responsible for improving access to an organization's information (Spector 2002), as well as the generation, codification, and transfer of knowledge. The technologist may also be responsible for the actual creation of sustainable knowledge management systems. In establishing a culture that "encourages people to view knowledge as something that continually grows and changes" (Adams, 2001), the instructional designer can take on the role of designing an evolving system as a knowledge manager. This reflects a very different role than simply developing and organizing training materials.

A further systemic impact of knowledge management is the value generated from sharing knowledge across an organization. From Spector and Edmonds (2000), we can conclude knowledge management is the end result from the evolution of information management systems. The focus is now on the humanness of technology-that of people working together for common goals versus the "technical aspects of technology" (Spector & Edmonds, 2000). The use of knowledge management also links users into a community of shared knowledge (Edmonds, 2002). Edmonds emphasizes the need to create a culture where instructors (or instructional designers) and their students (trainees) are willing to share their own personal knowledge as well as participate in the creation of new knowledge. The interaction of people, information and technology is what makes a successful knowledge management system-one that facilitates the creation and sharing of knowledge. This can be illustrated as follows:

Figure 4. Knowledge creation and the instructional environment (Guftason 2002)



As in the illustration above, Guftason (2002) reminds us that instructional design is not linear. There is "zig-zagging, top-down, bottom-up" aspects to the process. The challenge will be determining how knowledge can be used as an instructional design tool. How it can be adapted in this environment will be critical for the successful implementation of knowledge management.

The Cost of Knowledge Management

In acknowledging that knowledge management is an asset for any organization one must also recognize that its effective management requires an investment of money and labor (Davenport, 1996). Some companies estimate spending 7-10% of actual revenue on knowledge management. As noted earlier, the current costs of implementing and utilizing knowledge management systems in both business and education is substantial. The benefits as well as the risks of utilizing a knowledge management system must be explored along with those monetary costs to weigh the feasibility of its implementation.

The Benefits of Utilizing Knowledge Management

1. In the classroom or business setting, the implementation of knowledge management will facilitate the extension of information to future students and trainees. By having this knowledge captured and available, information will not be lost as managers of this knowledge come and go.
2. Activities can be organized around shared and reusable artifacts to achieve both specific and changing goals (Spector & Edmonds, 2000). For example, information and knowledge can be repurposed for different settings and requirements.
3. If emphasized as being important by the organization, knowledge management facilitates collaboration among team members (Gustafson, 2002). This further leads to a high level of quality knowledge that is then captured and stored, promoting an improved corporate culture.
4. Knowledge management promotes efficiency through structured document control (Gustafson, 2002) and improves long-term productivity by eliminating the need to constantly recreate training materials and manuals, which can lead to an increase in creativity and innovation, a strategic advantage for companies.
5. According to Spector & Edmonds (2000), knowledge management also facilitates access, archiving, retrieval and reuse of learning objects and instructional resources. When the knowledge of many individuals has been efficiently stored, new users can easily access the pieces they need in the development of additional tools and resources. In the training scenario, this would certainly cut down on the just-in-time recreation of materials that had previously been used.

6. During a downturn in the economy, intellectual capital is lost, due to layoffs and downsizing within a company. Even when the economy rallies, positions are reopened and new hires are brought on, time is limited for retraining and redeveloping the missing components. The development of a knowledge bank with a knowledge management system insures that potential knowledge loss is minimized and the knowledge has been captured for reuse later (Tobin, 2005).

Implementing and Managing Risk with Knowledge Management Systems

1. People involved in an organization will not "buy into" the changes necessary to make the knowledge management system successful. Tobin (2005) suggests that what is needed is a "change management plan". With the implementation of a knowledge management system, you will be asking people to do their jobs differently. To create a successful outcome, some of the areas that will need to be addressed include updating job descriptions, creating feedback sessions for employees affected by the change, and performance reviews designed to evaluate how the implementation is coming.
2. You must "set expectations or risk extinction" (Tobin, 2005). Just as in the implementation of other instructional design tools, the measurement of your outcomes with knowledge management will be necessary. Management must see from careful analysis that the implementation of the system is effective or the elimination of your system will come to fruition.
3. In both business and educational settings, a culture must be created where the sharing of knowledge as well as the creation of new knowledge is not only encouraged but also accepted. If there is no trust established the system will fail. Davenport (1996) suggests that knowledge management is "highly political" because knowledge is power. Knowledge managers can get buy-in from users by appointing "opinion leaders" to adapt the system and thus promote its usability and value.
4. If a thorough evaluation of KM tools is not made prior to the implementation, failure of the system may result. Gustafson (2002) indicates that every knowledge management tool will not work for your specific project or needs--you must choose the correct tool, thoroughly examine the tool before implementing it, and have informed and intelligent users if the desired results are to be achieved. Gustafson (2002) encourages a tool evaluation process to

determine if the tool is effective, valid and reliable. In other words, is the tool "appealing and engaging to learners"; is the tool "comprehensive and consistent in its application;" and finally does the tool meet the need of the group with its functionality.

It is important to keep a balance between the use of human capital and computers in knowledge management (Davenport, 1996). As we all know, computers can store and easily distribute knowledge that changes quickly. We must keep in mind that people still want to work with other people when they "want a rich picture of what is going on in a knowledge domain" (Davenport, 1996). In the implementation of a knowledge management system, the benefits and risks will be weighed against each other, but the human factor can never be ignored. The ultimate success of an implementation initiative depends on the users.

Implications

More than ever before, it has become vital for businesses to provide their employees with access to information that can be retrieved quickly and easily. This information is used to support job functions, direct decision-making and provide feedback to management.

Challenges to business

Knowledge Management systems contain a wide range of tools and procedures to meet the challenges faced by modern businesses. While no one solution solves all problems for all businesses, the solutions provided by a well designed and well thought out KM system can go a long way toward solving the challenges for many businesses. These challenges include:

- ensuring that the information being provided to employees is up-to-date, accurate and appropriate to their job function;
- placing an emphasis on what the technology can achieve rather than an emphasis on the need of the user; and
- developing a large knowledge base of information, but not continuing the necessary investment in resources to maintain the currency of the information or provide for adequate of training of staff in the use of the system.

In addition, dissemination of this information requires a system that can allow for change, growth, and the development of new knowledge, as well as link employees to a network of users not limited by geographic area or time constraints.

Benefits of KM to business

These challenges have led many businesses to adopt KM systems to manage their information and meet the needs of their employees.

The benefits of adopting a KM system can include (Robertson, 2002):

- improved accuracy of information being provided to customers and other users;
- greater flexibility in handling changing business processes, products, and information;
- increased staff satisfaction and morale; and
- reduced training time and costs for new staff.

Applying processes and procedures to business

Management support is imperative for a KM program to be successful. As we noted previously, some companies estimate that they may spend 7 – 10% of actual revenue on KM. Continuous management commitment and visible involvement is typically a prerequisite for driving a knowledge culture (Sarnoff, A. & Wimmer, T, 2003). The adoption of a KM system also requires that the system be actively marketed within the company to ensure that the system is accepted and used appropriately and efficiently.

Information provided in the KM system must be accurate and up-to-date. According to Roberts (2002), if staff do not trust the information contained in the KM system, they will return to using other sources, such as handwritten notes or 'cheat sheets.' Steps that can be taken to ensure accuracy of information can include:

- having a team in place that is responsible for updating the information,
- establishing communication channels within the company to ensure new information (such as changes to policies or procedures) is included quickly, and
- providing a simple way for staff to report errors and omissions.

Access to the information contained within a KM system also needs to be available quickly and efficiently. A well-designed KM system will include a search engine to allow the user to find the information they need quickly and without protracted searches, and simple navigation structures to make the system easy to use.

To accomplish this, the KM program should be connected to the needs of the user. According to Robertson (2002), this can be done by:

- involving staff in the design process to ensure that their needs are identified;
- developing prototypes and testing these with real users; and
- applying information architecture principles and methods to the information repositories, so that navigation and menu items are appropriate for the user.

Expectations about the solutions provided by the KM program need to be realistic. Overselling or over-promising the solutions will lead to skepticism and often result in rejection of the system. In addition, strategies need to be in place to provide for effective feedback from users, and procedures need to be implemented to provide for review and integration of user recommendations into the system.

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Continuing training of staff on the use of the KM system will ensure that they are aware of the full functions of the system and are using it to their best advantage. Finally, monitoring the usage of the KM system is very important and will help identify what the most valuable information is in the system and what information is missing. The goal of a KM program should be to enhance existing processes, not to create additional work.

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