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INTRODUCTION AND EXECUTIVE SUMMARY

For quite a few years, the buzz in the training industry has been about the imminent development of integrated enterprise-wide training and knowledge management systems. These systems would enable a company to gather knowledge and intellectual capital throughout its organization, develop it in “bite-size” pieces, and then organize and deliver that knowledge throughout the organization in unlimited configurations. These new integrated systems would provide top executives and the training manager total control over all training, how it is delivered--whether Web-based, instructor-led, or CD-ROM--and what and how much is learned by whom.

The predicted productivity improvements of such an integrated system that could provide individualized, tailored learning on demand in whatever quantity at whatever time is nothing short of enormous. Because of the strategic competitive advantage such an integrated system would provide, this topic has been the dream of the training industry and every technologically savvy training manager for the last ten years.

For various reasons, as will be described in this paper, the dream has taken a long time to be realized. The development of such a system was more difficult to accomplish than what was initially thought. Finally, that dream is now a reality. It is the Generation21 TKM™, or Total Knowledge Management™ system. At present, the TKM system is the only completely developed, integrated, enterprise-wide training and knowledge management system available.

Dale Zwart, Generation21 Learning Systems Founder and Chief Technology Officer, developed the TKM concepts outlined in this report. Over the past ten years, Dale has pioneered much of the current knowledge on enterprise-wide, web-based training solutions, and has developed the patent pending technology of “Dynamic Learning Objects™,” which is the foundation of the TKM system.

This paper describes the background, research, and theory supporting integrated enterprise-wide training and knowledge management systems and explains why the productivity gains of using such a system are so significant. Throughout this paper, and because the Generation21 system is the only example presently available, the Generation21 brand names TKM™ and Total Knowledge Management™ will be used interchangeably with the generic term of integrated enterprise-wide training and knowledge management.

TKM has these principle benefits and features:

- Employs “dynamic learning objects”--learners receive only the instruction needed
- Delivers “tailored learning” building on learner performance and learning styles
- Open architecture environment
- Very efficient at reusing information



- Supports both on-line and instructor-led training
- “Form-driven” authoring requires no programming skills
- Training record management tracks requirements, history, grade books, billing and learner preference model
- Data can be imported and exported to Peoplesoft, Oracle, and any ODBC database
- Certification management and regulatory compliance is a core competency

We hope this paper will provide you with important information that will help you make decisions about and implement an integrated enterprise-wide training and knowledge management system. If you need any additional information please let us know.

THE TEN THINGS EVERY TRAINING MANAGER SHOULD KNOW ABOUT TKM

1. WHAT IS TKM AND WHY IS IT IMPORTANT?

TKM DEFINED

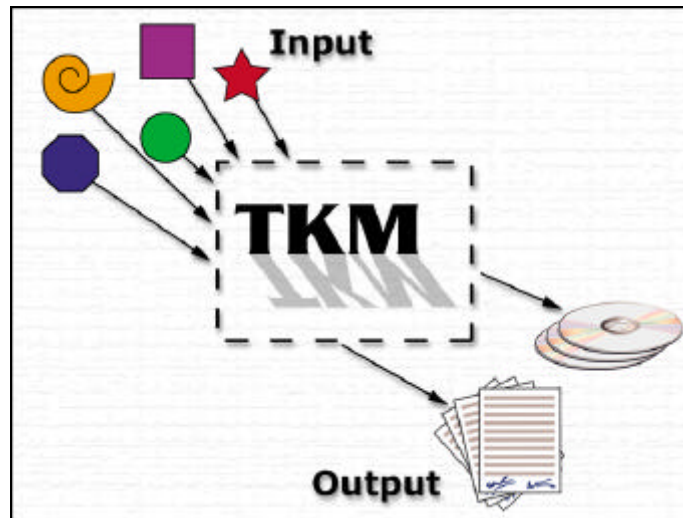
TKM—Total Knowledge Management is the application of using on-line technology to create a fully integrated training and knowledge management system that enables an organization—and all the individuals who support that organization—to share their collective knowledge and convert that knowledge into a training system that is based on dynamic learning objects.

As an Internet-based technology, the ability to create and distribute knowledge—to convert knowledge into value-added customer service—is a significant competitive advantage. The Internet creates the potential to restructure the economy on a global scale precisely because it makes knowledge universally available, creating a truly egalitarian society without boundaries or walls. Political and social barriers are irrelevant as we all become members of one global economy.

What does this transition mean for us as individuals and for the businesses and schools in which we work and learn? For us as individuals, it means that the special knowledge any one of us may have today will likely be known by everyone tomorrow. In fact, the pace at which knowledge expands causes us to look with wonder—even with occasional dismay—at the rate at which our knowledge and skills become obsolete in the marketplace. This change means that each of us must have continuous access to the most current knowledge and training in our fields to retain our own value in the marketplace.

For organizations, the consequences are equally significant—both ominous in their danger and exciting in the opportunities they may bring. The key competitive advantage for an organization is no longer held in the secrets kept by a few. This knowledge rapidly belongs to many. Intellectual property, privacy, and control of information and power are all fundamentally redefined when the click of a single button can send information to potentially millions of people.

THE FUNCTIONS OF A TKM SYSTEM



With TKM, the source of sustained personal growth and organizational competitiveness comes from the following six abilities:

1. **Gathering Knowledge**—The ability to gather knowledge through ongoing learning by the people within an organization as part of an organized structure
2. **Organizing Knowledge**—The ability to organize new information so that it is tied to and integrated with related knowledge
3. **Distributing Knowledge**—The ability to distribute that knowledge to others so that the necessary people can gain quick-and-easy access and learn quickly
4. **Converting Knowledge into Action**—The ability to convert new knowledge into action to provide higher value goods and services to others
5. **Training Ourselves Continuously**—The ability to convert information into training and learning for continual growth and improvement
6. **Repeating the Cycle**—Implementing this cycle on an ongoing basis so that new information is continually added to the system, distributed where needed, applied to the solution of new problems, and then used to enhance continual learning.

This process is the essence of the value of a fully integrated total knowledge management system. A Total Knowledge Management System does the following:

- Provides a repository for the ongoing acquisition of new knowledge
- Provides the structure by which new knowledge is integrated with previously deposited related information
- Makes that knowledge available to others in a 'just-in-time" fashion without extensive time lost searching for the needed information
- Provides continual training for individuals so that they can learn what they need to know on an ongoing basis
- Dynamically and continuously updates information and training so that the intelligence and skills of an organization reflect the synergistic result of the total capabilities of the organization.

TKM is the system that enables an organization to bring the power of its collective knowledge to every customer, delivered through every employee.

2. HOW DOES AN INTEGRATED ENTERPRISE-WIDE TKM SYSTEM CREATE COMPETITIVE ADVANTAGE?

THE VALUE OF ORGANIZATIONAL KNOWLEDGE

Why have individual and organizational learning recently become recognized and considered vital within organizations? What has caused training to emerge as a critical resource from its traditional role as a necessary evil that is often cut during difficult financial times? Why is training now highlighted as one of the key factors for organizational success?

What change has caused books about “creating learning organizations” to become best sellers and the authors of these books to become highly paid speakers and consultants to corporate executives?

What phenomenon has occurred from which companies now have “Chief Learning Officers” who report to the chief executive officer and share peer positions at the executive table, along with finance, sales, marketing, manufacturing, and other more traditional functional areas?

The answer to all these questions is fundamental to our understanding of the factors that create economic success. The rules that govern success in the newly emerging economy have changed profoundly. The hallmarks of the traditional industrial model—capital preservation, stability, predictability, resistance to change, long product development cycles followed by long-term manufacturing cycles—have all been turned upside down.

Speed, the free flow of information, intellectual property, constant change, continuous instability, increasing customer demands for increasing customer value, unsurpassed levels of quality, and the ability to attract and retain the best and the brightest have replaced the traditional, time worn measures of organizational competence.

For individuals, performance in exchange for loyalty and security has been replaced by performance in exchange for challenge, growth, and continuous learning.

For the chief executive officer, a TKM system provides the opportunity to extend alignment over his or her organization. The bigger and more complex the organization, the more founders and CEOs are concerned about the loss of control in the sense of not having the assurance that the direction, focus, and goals of the organization are clearly understood and followed by all. A TKM system extends the CEO's control and alignment based on required training, certifications, policies, procedures, and work processes.

If an organization is to grow and thrive in this emerging economy, it must value its own ability to learn above all else.

- It must be able to capture its knowledge and share that knowledge throughout its workforce.
- It must be able to convert that knowledge into positive action.
- It must be able to distribute new information rapidly and to use that new knowledge to change the behavior throughout the organization.
- It must be able to continually educate its workforce.
- It must be able to promise its workforce the opportunity for continual learning and challenges.

- It must be able to separate data—which is often “noise” in the system—from information that adds value to the system.
- It must be able to generate synergistic results using the power of people—recognizing that products and services themselves change so rapidly that the competitive advantage that depends on particular products today is guaranteed to become obsolete tomorrow.

This situation is why an integrated, enterprise-wide TKM system is an opportunity today—and an inevitability tomorrow.

THE TQM ANALOGY

TKM today might be compared to the Total Quality Management (TQM) movement of the early 1980s. When TQM first evolved as a concept, it was embraced by only a handful of companies. The concept that quality management through inspection and control could be replaced by error-free quality through process management—requiring measurement, feedback, and correction at the worker level—was foreign. As a result, the concept was rejected. But, when some companies (many of which were not in the United States) began to demonstrate dramatically different performance results, the concept began to be understood and appreciated at a higher level. This change in perception led to the widespread adoption of TQM. During this era, many companies adopted TQM in earnest; others continued to pay “lip service” to the concept, while not fundamentally changing their beliefs, their processes, or their management infrastructures. Many companies thrived; others went out of business. Still others survived but lost long-sustained positions of eminence in their marketplaces. The quality of products and services throughout the United States was subjected to unprecedented demands. Our industries responded with unprecedented quality improvements.

As an example, the average car manufactured in the United States in 1980 had between 11 and 17 average defects upon shipment—depending on the model and manufacturer. In 1999, the average car manufactured in the United States has less than 1 defect per car!

Where is TQM today? It seems to have lost its appeal and all but disappeared. The disappearance of TQM is not a sign of failure. Rather, it is a sign of the ultimate success of the concept. TQM as a “program” has indeed largely disappeared. Much of the movement—a movement that had so many zealots it almost bordered on a religion—has faded quietly into management history books.

But TQM in application has not disappeared. It has become embedded in the culture and processes of most organizations. Process ownership and process management are common organizational attributes. Feedback, measurements, statistical analysis, and process improvement are embedded concepts in business. Continuous improvement has become an expectation, not a special feat. Process improvement teams are normal components of organizational life. Empowerment of workers on the factory floor is an expectation—of both workers and management. TQM has become an integral part of the culture and lifestyle of organizations. Companies that do not deploy these concepts have little chance of long-term survival.

TQM has not died. It has succeeded and embedded itself into the practice of business today.

THE MATURITY LEVEL OF TKM TODAY

Today, the same parallel can be drawn to the concepts of TKM. Total Knowledge Management is still in the first phases of implementation. Companies that embrace TKM are on the cutting edge of experimentation. We are, however, rapidly learning exactly what the conditions and requirements are for a systematic TKM system that creates a sustained competitive advantage.

- TKM creates enterprise-wide knowledge and knowledge development.
- TKM creates a workforce that remains at the top of its learning curve.
- TKM creates the ability for knowledge to be used synergistically—growing and adding to the collective learning of the enterprise.
- TKM makes possible the true learning organization.
- TKM offers state-of-the-art training and learning to all employees

TKM today offers a competitive advantage for companies that embrace it at this relatively early stage of development. TKM also offers the following additional benefits.

Continual improvement. TQM provides a powerful tool to ensure continual improvement. Improved revenue, improved quality, improved efficiency, improved employee retention, and improved customer retention are all outcomes of training the right people on the right things. The improvement should show on the bottom line. TKM offers that opportunity.

Motivation. Knowing you know what you need to know is highly motivational. Poor training hurts morale. Feedback is motivational. This message is powerful in both schools and business organizations.

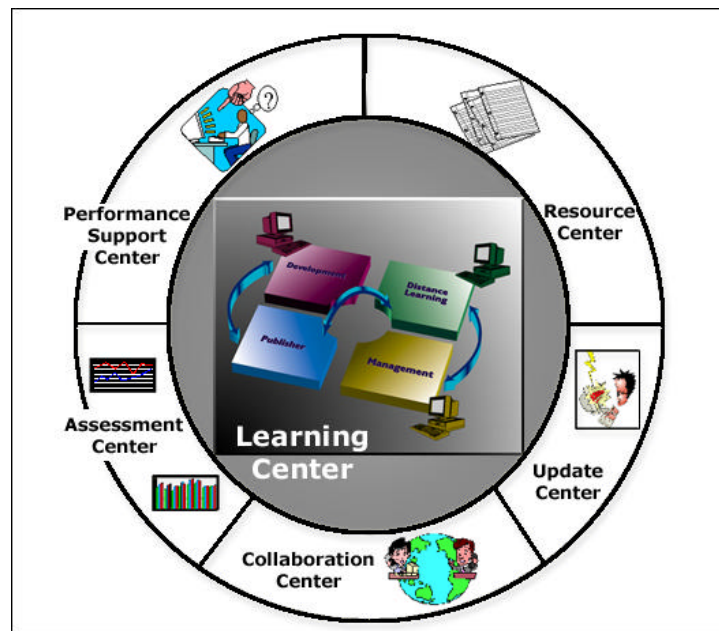
Currency. This concept refers to the “up-to-datedness” of available information. One of the greatest challenges of organizations is providing individuals with rapidly changing information and training in the ever-increasing speed of today’s competitive environment. CEOs, managers, trainers, and employees all need and desire the most current information. TKM enables this desire to become a reality.

TKM is an inevitability for all organizations to sustain a long-term competitive advantage. The lack of an integrated TKM system over the next several years will create a significant competitive disadvantage for those who allow this opportunity to pass them by.

3. WHAT ARE THE ESSENTIAL MODULES NEEDED FOR A COMPLETE TKM SYSTEM?

Many different approaches can be taken to develop the infrastructure and architecture for a complete TKM system. Regardless of the system, however, a number of elements are essential for a technology infrastructure to provide a fully enabled TKM enterprise solution, including the gathering, organizing, distributing, training, and updating functions that converts knowledge into action.

The essential elements of a TKM system are described below.



CURRICULUM DEVELOPMENT MODULE

The Curriculum Development Module is the entry vehicle through which new information is added to the TKM system.

- The Development Module must be based on learning object architecture, so that information can be entered in small “bites” that can be related to each other and utilized as needed.
- The Development Module also must include a relational database, so that all information can be readily stored in such a manner that individual learning objects can be tied in multiple relationships to be recalled instantly on demand.
- The Development Module must be user-friendly and not require any special programming skills or extensive training, so that individuals throughout the organization can easily learn how to contribute to it.
- The Development Module should be based on Instructional Systems Design learning theory, so that it focuses on performance and uses task analysis and learning hierarchies to create valid training materials, as long as content experts provide the information.

- The Development Module must be structured so that data can be entered easily, aligned in small components for multiple applications, and easily changed and enhanced as new knowledge is continuously added to the system.
- The Development Module must be based on an open systems architecture, so that the large amounts of preexisting information in an organization already developed on multiple platforms using different technologies can easily be re-purposed and entered into the system as reusable learning objects.

PUBLISHER MODULE

The Publisher Module is the vehicle through which individual learning objects are dynamically compiled and then produced—or published—to be received by the end user.

- The Publisher Module must publish dynamically, so that materials are newly published every time they are requested, containing the most current information that may have just been entered into the system.
- The Publisher Module must be able to use many different learning objects in multiple configurations and sequences to meet different learning needs.
- The Publisher Module should have a template structure, so that all materials are driven through common templates. This means that every company or organization can create its own “look and feel” simply through its template design. It also means that individuals who contribute knowledge using different formats, type fonts, and so forth need not worry—the system automatically creates one common look and feel through its template structure.
- The Publisher Module must have the capability to publish its outputs in multiple modalities. Electronic outputs must be sized and shaped for Intranet or Internet delivery. The same materials also should be publishable as print documents, for the learners, for trainers, in overheads, and so forth. The Publisher Module also should be able to produce the same materials as CD-ROM-ready files, so that locations that do not have easy accessibility to Intranet or Internet connections can still obtain the materials electronically.

DISTANCE LEARNING MODULE

The Distance Learning Module is the connection between the TKM System and the user, or learner.

- The Distance Learning Module must create a customized Web page for every learner, so that the accumulated records and history for that learner can be readily accessed.
- The Distance Learning Module must have easy, user-friendly navigation capabilities, so that no training is required for the learner to access the system.
- The Distance Learning Module must be a simple browser-based module, with no required plug-ins, so that anyone can use it from any hardware or software platform.
- The Distance Learning Module must have internal connections within the TKM system to the Publisher Module to receive materials, to the Development Module, to the Management Module, and to all other modules that provide access to information needed by the user.
- The Distance Learning Module must be able to test learners dynamically to determine what they already know and then instantly access the Development and Publisher modules to create personally tailored tutorials for every learner, based on what they need to know at that moment and what they already know.
- The Distance Learning Module should also contain a direct live (e-mail) interface with an individual designated as the “content expert” for that field, so that further information and dialog is easily and immediately engaged.

MANAGEMENT MODULE

The Management Module contains the cumulative information about the users and their learning records through both formal training events and individual on-line learning.

- The Management Module must contain its own independent, relational database, so that it can provide all the information needed by that organization.
- The Management Module must be able to be customized to meet the needs of every enterprise using the TKM system.
- The Management Module must have a published API, and be able to interface with all other databases containing personnel records and information, such as Oracle, Peoplesoft, and any other ODBC database.
- The Management Module must have complete scheduling and registration capabilities, so that both instructor-led training classes and all on-line registrations can be handled through one central system.
- The Management Module must have connectivity to e-commerce, so that an organization using its TKM system to deliver revenue-generating training and knowledge to others can use it as a source of revenue and as an independent profit center.
- The Management Module must be able to provide information by content area, by course, by instructor, by functional organization, by individual, and so forth. In short, this system must have the flexibility to provide whatever organizational information is required.
- What learning modalities best fit the nature of the instruction and the nature of the learner?

ASSESSMENT MODULE

The Assessment Module provides the capability to develop and score general assessments to measure needs, knowledge, skills, or attitudes among employees, customers, or any other group who may use the TKM system.

- The Assessment Module must have the ability to create custom assessments that can be delivered over the Web or converted to other forms of delivery.
- The Assessment Module must be able to take completed assessments and instantly—dynamically—score them to provide individual results.
- The Assessment Module must be able to convert assessment scores into a recommended learning curriculum that is dynamically generated for each learner and then offered to that learner through the Distance Learning Module.
- The Assessment Module must be able to analyze data against any desired criteria, apply standard statistical analyses, and generate individual and group reports.
- The Assessment Module must be able to develop and produce output reports for both individuals and groups that can be delivered either electronically or on paper to any individual with access privileges to that information.

PERFORMANCE SUPPORT MODULE

The Performance Support Module is an indexed search function that accesses the entire relational database of learning objects. It enables any user to engage the system to request specific information that is required at that precise moment to support job requirements or any other desired information.

- The Performance Support Module must have an “easy-to-use” search engine, with many reestablished, menu-driven key words designed specifically for that organization.

- The Performance Support Module must contain data that is organized by job function or other similar performance categories that supports that organization's TKM requirements.
- The Performance Support Module must be able to instantly and dynamically call up those learning objects that relate to the requested topic from both information and training modules.
- The Performance Support Module must connect to the dynamic testing component of the Distance Learning Module and the Management Module, so that this function also offers dynamic testing and maintains a record of new knowledge and competence achieved by the learner.

RESOURCE CENTER MODULE

The Resource Center Module connects the TKM System to all other sources of information within the organization, so that other files and databases can all be accessed easily, transparently, and instantly through the TKM System.

- The Resource Center Module must have full open architecture multiple platform connectivity to all other organizational databases.
- The Resource Center Module must have access privileges and protections as specified to ensure that proprietary company information is shared only with those individuals who should have access to this information.
- The Resource Center Module must enable the TKM system to connect the full repository of company knowledge to every individual needing this information.
- The Resource Center Module also should have a full search engine, so that it can help the user gain easy access to the desired information.

UPDATE MODULE

The Update Module serves as the initial source of reference for new information or modified information about a particular topic. This module ensures that users remain current and updated as new information is continuously added to the TKM system.

- The Update Module must appear as a first level access point from the Distance Learning Module.
- The Update Module must use "Server Push" technology to send updated information directly to all those in need of this information.
- The Update Module must be able to define categories of interest groups against multiple variables, so that updated information can be sent to all those who need it.
- The Update Module also must be connected to product upgrade requirements, certification requirements, regulatory requirements, and configuration control requirements to ensure currency in all these categories for all identified individuals and groups.

COLLABORATION MODULE

The Collaboration Module is the vehicle by which individuals use the TKM system to connect with others, extending the knowledge transfer and learning process and building in the interpersonal components essential for learning in a social environment.

- The Collaboration Module must have a direct e-mail connection to the designated "content expert" for each major content section of an organization's TKM system.
- The Collaboration Module must include a "chat room," so those individuals who share common interests can communicate directly with one another.

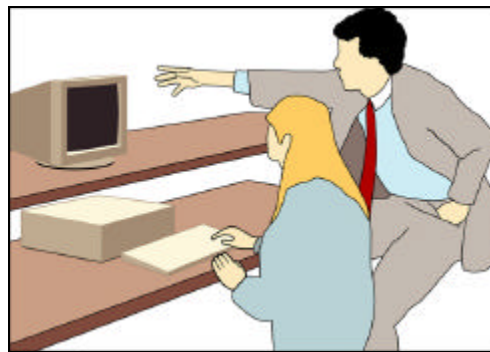
- The Collaboration Module also must have a “message forum” capability, so that ongoing learning can be captured and retained for topics in which the cumulative information adds new knowledge to the system.
- The Collaboration Module must have the capability to link directly with synchronous learning systems so that live technology-supported interactions can be used in an integrated fashion with the TKM system
- The Collaboration Module must contain streaming media capabilities so that “just-in-time” information of a temporal nature can be shared throughout an organization.

The nine modules described above form an integrated TKM system as long as they are interconnected, take the same information from a common relational database, and create and use that information in the form of dynamic learning objects that enable the system to be continuously expanded and enhanced.

4. WHAT ARE THE THREE AUDIENCES A TRAINING MANAGER AND TKM SYSTEM NEEDS TO SERVE?

TKM is a system that supports and enhances enterprise-wide training and knowledge management. Training managers ensure that the employees of an organization receive the training required to perform their jobs and to enhance the overall capabilities of the organization. A TKM system and a training manager have common goals.

To achieve these goals, training managers and TKM systems must serve the three audiences who create their core purpose for existence. Each of these three audiences has different requirements. The manager and TKM system must be responsive to all three purposes.



FIRST—THE LEARNER

Learners—also called students, employees, and participants—have several requirements and expectations. Both training managers and TKM systems must design their infrastructures and their delivery models to serve these purposes. The following issues are of key importance to learners:

- Learners want to be assured that they will be taught what is required for them to perform their jobs successfully.
- Learners want a non-threatening learning environment—an environment in which they can be open, make mistakes, show ignorance, and experiment without fear of reprisal.
- Learners want a friendly and challenging learning environment. Learners want to be motivated and excited by the learning experience.
- Learners want the opportunity to practice in a “safe environment” before they are asked to apply new knowledge and skills in their actual work environment.
- Learners want feedback—from the instructional process, from each other, and from the trainer. Learners want to know how well they are doing, so that they can make necessary adjustments and course corrections.
- Learners want reinforcement and praise when they have done well.
- Learners want others in the organization—especially their managers—to know when they have had a successful learning experience.
- Learners need to know that they are being taught the most current knowledge and skills available to them in their field, increasing their ability to perform in their current job, prepare for greater levels of responsibility, and maintain the highest possible level of employability in the marketplace.

SECOND—THE TRAINER

Trainers—also called instructors, teachers, coaches, mentors, tutors, and managers—have several requirements of their own to provide the best learning environment for their students. The following issues are of key importance to trainers:

- Trainers want to know that they are providing training for the right knowledge and skills—that a proper job and task analysis has been performed so they are teaching “the right stuff.”
- Trainers want to know that their instructional program has been well designed and that the best and most current resources are available to them. Trainers want the best curriculum possible.
- Trainers want a good physical learning environment—facilities, space, resources, technology, and so forth to optimize the learning environment.
- Trainers want their learners to want to be there. They want the students to have a genuine interest in the training and to have their attendance and their participation supported by their management and the organization.
- Trainers want to do a good job. They want to excite and motivate their students and know that they have taught well, that the students have learned well, and that both enjoyed the experience.
- Trainers want and need feedback about how well they are doing while they are training, how well the learners are learning, and how well the learners apply their new knowledge and skills after the training experience.
- Trainers want to be recognized for the quality of the job they do and for their contribution to the organization and the fulfillment of the organization’s purpose.

THIRD—THE ORGANIZATION

Organizations—also called companies, schools, businesses, agencies, departments, enterprises, and societies—have their own requirements and expectations for the learning experience. The following issues are of key importance to organizations:

- Organizations need to know that the training being provided is aligned with the organization’s core purpose, mission, values, and goals.
- Organizations want the training to prepare their workforce for the expected and unexpected circumstances that they will face while performing their jobs.
- Organizations want to know that the training has been designed with consideration for both effectiveness and efficiency—attending to issues of space, cost, time for training, and time off the job.
- Organizations want feedback from the learners, from the managers of the learners, from the trainers, from the organization as a whole, and from the organization’s customers.
- Organizations want to be able to measure the effects of training and its impact on the workforce. They want to be able to analyze the return on their investment (ROI) for the training that they have provided.
- Organizations want training to have demonstrable effects on the organization’s ability to serve customers, to contribute to performance and productivity, and to add value and to enhance long-term profitability. Organizations want their training to create a genuine competitive advantage—both in the ability of their workforce to serve customers and in the ability of training to help recruit and retain employees
- Organizations want to be recognized in their marketplace for the quality of their workforce and for the quality of their training of that workforce.

The requirements and expectations of these three groups—learners, trainers, and organizations— establish a clear set of expectations for a training manager and a TKM system. These requirements can be divided into three categories:

1. **Designing and Developing the Training Experience**

Learners, trainers, and the organization want a training experience that is aligned with the organization's mission, provides appropriate job-related training, and is both effective and efficient in delivery.

2. **Delivering the Training Experience**

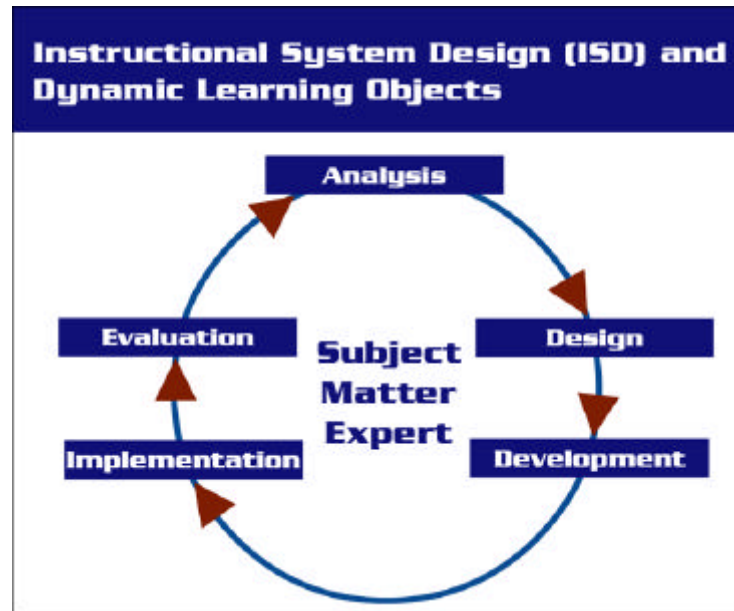
Learners, trainers, and the organization all want a training experience that will be successful, that is motivating and challenging, and that is delivered with as much efficiency and flexibility as possible.

3. **Evaluating the Training Experience**

All three groups want to know how they are doing. Feedback and measurement during and after the experience and in on-the-job performance are essential ingredients for a TKM system. Feedback and measurement are necessary to know what is or is not working and to make continuous improvements essential to any learning environment.

TKM and training managers share these common purposes in meeting the needs of their respective audiences. Working together, trainers and TKM systems can apply both human and technology-based skills and attributes to create breakthrough learning results.

5. WHAT IS ISD AND WHY IS IT IMPORTANT?



ISD DEFINED

Many people think that content and curriculum are the same thing. Actually, they are quite different. Content is the information—the knowledge—that is shared with others. Curriculum is the way in which content is converted or transformed so that the desired learning occurs.

Several factors influence curriculum and the degree to which the desired learning outcomes occur. Some of the factors that need to be considered include the following:

- What are the learning goals or desired outcomes of this instruction?
- What is the content or information that needs to be conveyed?
- What are the values or attitudes that need to be taught?
- What are the performance requirements or standards that must be achieved as a result of this learning process?
- How is this content best sequenced?
- What instructional methods and media should be used?
- What assessment measures should be used to determine if learning has taken place?
- What is the best environment to ensure that the desired learning will occur?

Several curriculum development models are in common use. Of all these different models, one of the most useful and practical methods that has been validated over the past forty years is that of Instructional Systems Design, more commonly called ISD.

Instructional Systems Design (ISD) is a proven methodology for subdividing learning outcomes into their components and arranging those components in a hierarchy from simple to complex. ISD methodology is the most validated approach for developing curriculum that is focused on building skills and performance-based applications.

Instructional design is systematic; it is an orderly, logical method of identifying, developing, and evaluating a set of instructional strategies aimed at attaining a particular goal or learning outcome.

ISD research is an outgrowth of systems theory. This theoretical model is found in engineering principles, cybernetics, computer science theory, systems analysis research, and other similar scientifically based applications.

Instructional Systems Design^{3/4} while not the only way to develop curriculum^{3/4} has been proven to be the most effective and efficient method for developing performance-based curriculum.

The ISD process can be compared to the software development process. Most software developers will tell you that a clear and well-defined set of specifications will create a much tighter, faster software development effort with far fewer bugs and future corrections. Clear specifications also limit the “feature creep” phenomenon that often waylays software development projects. The essential condition is that the end user of the desired software must have the ability at the beginning of the process to define what the desired outcome should be—complete and in detail. The software developers must then analyze and divide those desired outcomes into the components required to achieve them, convert them to a development algorithm, and apply common software development principles and disciplines that will guarantee this outcome. This strategy has become the accepted methodology for software development.

ISD is the educational parallel to software development. A clear definition of the end result, the division of that end result into its components, the sequencing of those components, the subsequent development of each component using appropriate methods, and a defined disciplined development methodology produce the desired outcome.

Although highly respected researchers have presented many different ISD models, virtually all ISD models can be broken down into the following five core phases:

PHASE ONE - ANALYSIS

In the Analysis phase, the nature of the task to be learned and the learning requirements are studied. One of the fundamental steps in this process is a task analysis of the required performance. This analysis divides the task into its steps; establishes the sequence by which these steps should be learned; and defines the knowledge (content), attitudes, and performance skills required for each step. Some of the factors to consider during analysis include the following:

- What are the performance outcomes required of learning this task?
- What is the hierarchy of knowledge, skills, and attitudes required to perform this task?
- What is the sequence of steps required to perform this task?
- What steps, if any, are prerequisite to each other?
 - Must they be learned in a particular sequence?
- What key prerequisite knowledge or skills must the learner have to be able to learn this task?
- What special environmental conditions or concerns—safety hazards and so forth—need to be included in the ability to complete this task?

- What special restrictions or limitations among this group of learners will impact their ability to learn how to perform this task?

PHASE TWO - DESIGN

The actual instructional design is created in the second phase of the process. At the end of this phase, the structure, sequence, and instructional methods to be employed in the course will have been determined. Key questions of the design phase include the following:

- What is the best way to structure the required learning outcomes into an instructional design?
 - This step defines the course goal, divides the course into its major instructional modules, subdivides modules into individual learning units or lessons, and identifies the specific competencies or skills that comprise each instructional unit.
- What is the sequence in which the instruction will be delivered?
- What content and skills will be included in each competency and unit?
- What is the optimal size of each unit or lesson?
 - How large is it?
 - How long does it take to learn?
 - What is a reasonable amount of knowledge and skill to learn at one time?
- What are the best instructional methods to learn this knowledge or skill?
 - Is this goal appropriate for technology-based instruction?
 - Is the information best learned in a social or classroom setting?
 - Does the knowledge require actual skill practice or applications that may require a laboratory or job site?

PHASE THREE - DEVELOPMENT

In the Development phase, the instructional design is converted into a real curriculum—content is written, lessons are developed, instructional support materials are prepared, and measurement tools are created. Some of the factors to consider during development are as follows:

- What detailed information or content is needed to achieve each instructional outcome specified in the design phase?
 - Is this content being prepared at a level appropriate to match the skills and maturity of the learner?
- What instructional activities will best match the content and the nature of the learning goal?
 - For example, the development of interpersonal skills requires that people interact with each other in a social setting. The development of performance skills requires actual practice of that performance. Instructional activities must match the desired instructional outcomes.
- What learning modalities best fit the nature of the instruction and the nature of the learner?
 - Is this goal best learned visually? Through auditory channels? Experientially? Have multiple senses and learning modalities been included?
 - Have alternative learning modalities been incorporated to respond to different learners with different learning preferences?
- If the design is being developed as technology-delivered learning, are as many learning modalities and interactions as feasible being built into the process to maintain learner interest and attention
- What are the most appropriate measures to test for the desired learning outcome?
 - Can the learning be measured directly as well as indirectly?

- What is the best combination of effectiveness and efficiency to assess the level of learning that has occurred?
- Has the curriculum been developed with consideration for the learning environment?
- Must limitations of time, space, cost, resources, and so forth be factored into the learning process?

PHASE FOUR - IMPLEMENTATION

Implementation is the phase in which the curriculum is implemented with live learners to determine whether it is accomplishing its intended results. Key factors to consider during this phase include the following:

- Are the learners achieving the desired goals? Is the instruction effective?
- Is the instructional process taking approximately the amount of time and effort expected? Is the instruction efficient?
- Are the learners enjoying the process? Will they use it?
- Are the instructional steps in the right sequence?
- Are there any key points along the way that seem to create problems and require relearning or special support?
- Do any of the steps seem unnecessary or unwieldy?
- Can the efficiency or cost-effectiveness of the process be improved?

PHASE FIVE - EVALUATION

This phase formally examines the effectiveness and efficiency of the instruction, including factors such as whether the instruction is working, how efficiently it is working, and the feedback from the learners. Some of the key issues during this phase include the following:

- Prerequisite skills
 - Was everything that the learner needed to know or have before the instructional process began identified?
 - Does anything need to be added?
- Formative assessment
 - Did the learners work through the instructional process well?
 - Did learning occur at each step as planned?
 - Was instruction smooth and well received?
- Summative assessment
 - Were the final learning outcomes achieved?
- Qualitative assessment
 - Was the process as efficient and cost effective as possible?
- Learner assessment
 - Was the process completed?
 - Was it efficient?
 - Was anything missing?
 - Was anything added that was not needed?
 - Was it enjoyable?
 - Was it motivating?
 - Would you use it again if you needed it?
 - Would you recommend it to others?
- The last step begins the cycle over again.

ISD is the formal process of designing and developing instruction based on a clear intent. It starts with the end result in mind—what do we want the outcome of the instruction to achieve? This outcome requires a very clearly defined requirement in the beginning of the process.

When ISD principles are applied to the information entered into a TKM system, each component—or individual competency—is developed as a separate learning object. Because the ISD process defines the relationship of these components to each other through the task hierarchy, the individual software objects can be applied and assigned in endless configurations to meet learning needs.

ISD and learning objects work together to create the TKM infrastructure. Adding the ability to generate tailored training through the dynamic configuration of these learning objects to meet the unique needs of every learner creates the breakthrough outcomes that are achieved only through an integrated TKM system.

6. WHAT ARE DYNAMIC LEARNING OBJECTS, AND WHY DO WE NEED THEM?

We live in an environment of continuous change and improvement. In a dynamic environment, training requirements change continuously as well. A state-of-the-art total knowledge management system (TKM) responds instantaneously to shifting conditions. This response is the value provided by Dynamic Learning Objects.

LEARNING OBJECTS DEFINED

The term “learning object” comes from its predecessor term “software object.” A software object is a piece of software that can do something useful. This piece of software has hooks at its beginning and end, so that it can be attached to other pieces of software. The software is designed to be reusable, so that it can be placed in different applications without having to be rewritten all the time.

A piece of software, for example, asks for a social security number and then verifies that the number provided has the correct number of digits and represents a valid number. This piece of software is relatively small but is one that would be used time and again in many applications. If that simple piece of software were bundled with a beginning and an end, it would be a “software object” and would save time for software developers. If this code were properly written and tested, potential errors in writing this code would be eliminated.

The idea of applying the concept of software objects to training content was first developed by Dale Zwart, co-founder and Chief Technology Officer of Generation21 Learning Systems. Dale’s background includes formal training as a programmer through his initial degree and military experience. His background as an educator came from his graduate studies in adult education and his assignment as the Training Manager for Lockheed-Martin at Cape Canaveral.

While on assignment at Cape Canaveral, Dale faced the challenge of developing and implementing training systems that would support the many thousands of tasks needed to be performed in support of the space shuttle and related launch vehicles. The solution that he created—and which is still in use at Cape Canaveral today—was the original conceptualization and practical application of dynamic learning objects.

The concept of a “learning object” as developed by Dale is fundamentally the same as the concept of a software object. A learning object is a piece of instruction that creates a desired learning outcome. For a piece of instruction to become a learning object, the following four elements must be present:

1. A learning goal, or outcome, must be defined. If instructors use this learning outcome, will the defined learning result be achieved?
2. Some content or information must be associated with this learning outcome. What does the learner need to know? What is the instructional information that is being presented?
3. The capability must exist to add some instructional media to support this learning outcome, especially for technology-based instruction. The media might be pictures or graphics or an audio or video file. The media might be animation or an interactive exercise. Any instructional support that augments the content is designated as a media record.

4. The learning object must include some measure to determine whether it was achieved by the learning. Very often, measures are multiple-choice questions. True-false, fill-in statements, and matching questions also are common. Measures also can be interactions that the student has to complete. A performance requirement might also be specified as the measurement, which might require observation by an instructor.

In summary, a “piece of learning” should have the following four elements:

1. Defined learning goal, or outcome
2. Content or information needed to achieve the learning outcome
3. Associated media or support material
4. Measures to assess when the learning outcome has been achieved

When this piece of learning is integrated as a software package, it becomes a “learning object.” For the learning object to be useful, we must be able to call for the goal, content, media, or measurements on demand and use whichever parts we need at that moment in time. The parts must “know,” however, that they are part of the same learning object and are linked or associated with each other. When the entire learning object is needed, all four elements should automatically come together as one, integrated learning object.

CRITERIA FOR A DYNAMIC LEARNING OBJECT

The dynamic nature of learning objects is created by their ability to do the following three things:

1. They must be able to be used in whole or in part and on demand.
2. They must be able to be modified or changed on demand.
3. They must be able to be used in conjunction with each other in an infinite variety of combinations and on demand.

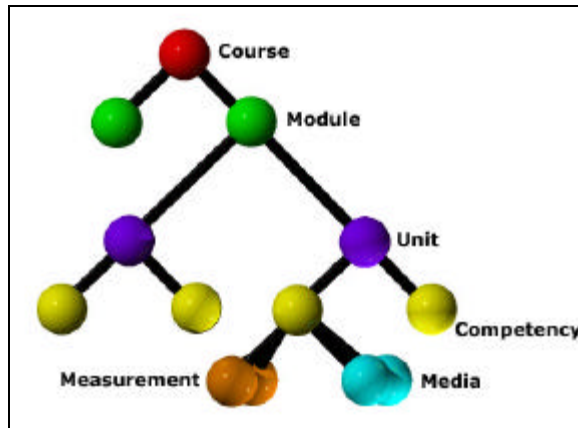
Learning objects are called dynamic because they respond dynamically on demand—to how they are being used, to being updated or changed, and to becoming part of some larger unit of instruction.

BUILDING “RIGHT-SIZED” LEARNING OBJECTS

If we were to define a learning object broadly, we could claim that any course is a learning object. After all, a course has a learning goal or outcome, it has content, it has media or support material, and it has tests or measurements. And if this course were to be placed on a CD-ROM or in a file for Web-based delivery, it could be called a learning object.

Technically, this is true. In fact, a number of companies have done just this. They have taken complete courses or large blocks from complete courses and simply renamed them “learning objects.”

While this scenario may be technically true, it defeats the very purpose and intent of learning objects. For learning objects to have high value—especially if they are dynamic learning objects—they must be as small as possible to achieve a “bite” of learning. If a learning goal can be achieved in a 5- or 10-minute instructional activity—and in a variety of applications, it has independent value. And if it has independent value, it should be identified as a unique learning object.



AN ANALOGY

Let's compare the development of a course to the construction of a brick wall.

If we were going to build a wall—and this wall was never going to be changed or torn down, we would want the wall to be custom designed to its exact specifications and dimensions. Since it takes time and costs money to make individual bricks and to lay these bricks, we would want the bricks to be as large as possible and still be usable. Fewer bricks mean less work.

The end result would be a very solid—but inflexible—wall. If we ever needed to move or change this wall, it would be very costly, if even possible.

Now let's assume that we want to build a wall that would need to change over time. Now we must build for flexibility. We should build the wall of smaller bricks, because smaller bricks can be reconfigured to make different walls of different sizes and shapes. We also want the mortar that holds the bricks together to be very solid while the wall is in place and also able to be removed, so that the same bricks can be reused to make new walls.

This analogy holds well for dynamic learning objects:

- They must be small to maintain their flexibility.
- They must be reusable in infinite varieties of configurations.
- They must be flexible so that they can be redesigned or changed.
- They must be able to be used in any combination.
- While they are together, they must hold on to each other seamlessly.
- When they are taken apart, they should come apart cleanly so that they can easily be reused in other configurations.

Dynamic learning objects, therefore, are small, reusable, changeable, transportable learning objects. A TKM system enables the developer—even the learner—to create and re-create these blocks in endless configurations. TKM provides a dynamic learning environment responsive to the changing needs and requirements of learners and their learning environments.

7. HOW DOES A TKM SYSTEM CREATE TAILORED LEARNING FOR EVERY LEARNER?

People need to know different things at different times. Learning needs are a combination of what people are required to know (on the job or in the classroom) and what we already know from life experiences. A tailored learning environment continuously customizes the learning experience against these requirements through a process of ongoing assessment and feedback.

By nature, learning is a unique, individualized experience. We all learn in our own way, at our own pace, and in our own time. Our ability to learn is filtered by our needs at that moment, by what we have already learned about the topic, by what we want to gain from the learning experience, and all the other factors that are present while learning.

Most of us have attended a class with a friend or colleague, only to learn that after the class you learned different concepts in the class. I recall participating in college lectures where my notes were completely different from the notes of my friends! We had underlined different parts of the book and thought that different parts of the lecture and text were important. How could this have happened? The differences, in part, were based on what each of us already knew, on what was interesting to each of us, on what we each thought the professor was emphasizing, and on what would be on the upcoming exam. Our own personal filters (worries about the grade and getting a job) were influencing our ability to listen and affecting what we were hearing.

Although we were in the same room at the same time, we were not hearing the same information nor interpreting it in the same way. The “signal” (the learning message) and the “noise” (all the other stuff going on in our heads and in our lives) were impacting the learning outcome.

The complexity of the teacher’s needs and behaviors also must be considered. What is the teacher’s bias and filter? How does the teacher want to influence the learning outcome?

Now let’s add the broader social learning context. Perhaps this context is the learner’s job and the company for which the learner is working. Maybe it is the learner’s boss, who has designated a specific work assignment dependent on the outcome of this training. Maybe the context is an academic classroom with the pressure of an upcoming test. Maybe it is preparation for annual standardized exams or SAT tests.

The combination of these three major variables—the broader social environment, the content and approach created by the instructor and the needs of the learner—impact what the learner is expected to learn and what the learner can learn at any moment in time.

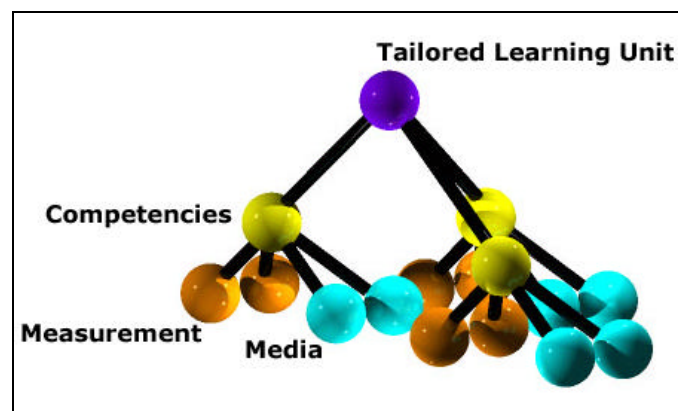
WHY TAILORED LEARNING IS AN IMPORTANT CONCEPT

If we could actually tailor, or personalize, the learning experience for every learner based on their needs and the context of their learning environment at a given moment in time, we could deliver learning that creates the most meaningful and powerful learning outcome. The learning “signal” would be powerful and strong, and the background “noise” would be minimized, if not eliminated.

How can this outcome be accomplished? In the classroom setting, this challenge is difficult. The instructor is typically required to deliver instruction that accommodates the average skills, abilities, and interests of the class. This approach works well for some students, is too slow for others, and is too fast for a third group. But, it is the best approach in a group setting. Clearly, the larger the group, the smaller percentage of students who are just right for the instruction. As a result, large lecture halls require supplemental small discussion groups to support those learners who did not learn what they needed in the lecture experience.

This example makes a good argument for smaller class sizes. Naturally, the smaller the group, the more ability the teacher has to deliver instruction that is tailored to the needs of each individual learner.

Ideally, the best solution is one-on-one tutoring or coaching sessions. Unfortunately, the cost factors and efficiency levels make this approach unfeasible for most situations.



HOW TKM CREATES TAILORED LEARNING

The potential benefit of a tailored learning environment driven by a Total Knowledge Management System (TKM) is the ability to create a truly tailored learning experience that is specifically designed and created for individual learners. The TKM system would include the following factors:

1. Requirements for the job or course

- The learning experience is designed at the macro level, based on the job or course requirements for the overall learning experience. What, for example, is the content of troubleshooting a K38 computer? What are the steps to follow in responding to an angry customer? What is the content for a class in U.S. history of the twentieth century?
- In this step, all the knowledge, skills, and attitudes that comprise what is needed to achieve the learning outcomes for a specific course or job are developed.

2. Unique needs of this learner

Perhaps this learner will be working in a particular customer environment, handling a certain type of customer, or preparing for a specific standardized test. The TKM system can now take the universe of information represented in this course or job and develop an individualized—tailored—course for this learner's individual circumstances.

3. Determine what the learner already knows about the subject

Once the overall course is determined, based on the job or course requirements and modified for the needs of the learner or group of learners, the individual question of assessing what this learner already knows can be addressed. This assessment is accomplished through a personalized pretesting experience. Based on the pretest results, the system can now dynamically—in real time—further customize or tailor this course by eliminating everything that the learner already knows and then sequencing what is still needed to optimize the learning experience. This process makes the learning experience more efficient, reduces cost and time, and also reduces the boredom often associated with presenting learners with information that they already know.

4. Determine how accurately and how rapidly the learner is getting the new information and skills

Throughout the learning experience, formative or live testing can determine how well and how quickly the learner is grasping the new information. Based on this ongoing feedback, the TKM system can modify content, sequence, and learning style dynamically to meet the needs of the learner.

The tailored learning model below shows how we can take a large universe of information and use the technology inherent to an integrated TKM system to rapidly determine which components are needed by the learner and what the learner already knows and then dynamically adjust the learning experience based on each learner's ability to grasp and apply the new information.

The result is a personalized experience that delivers what is needed by each learner to that learner, providing a truly tailored educational experience.

8. HOW DOES A TKM SYSTEM SUPPORT MULTIPLE LEARNING MODALITIES?

LEARNING STYLES

Each individual has a preferred learning style. Some people prefer to learn by reading. Others learn by viewing or watching. Still others learn by interacting in a social setting. Some prefer tactile or experiential learning. For some, learning is a conceptual experience, and the tangible applications are something that they prefer to do on their own outside of the formal learning environment. For other learners, the learning experience needs to be a concrete, highly structured experience in which they directly practice the new performance, receiving feedback and encouragement until the desired level of achievement or mastery is reached. The common name for these preferences is learning “modality.”

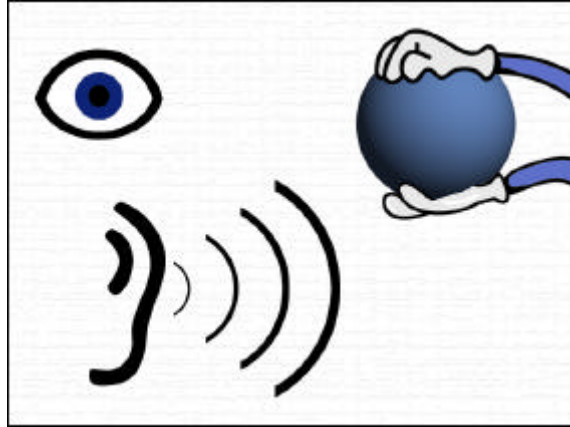
In a total learning environment, many forms—or modalities—of learning exist. A detailed analysis of many common instructional methods has led to the following classification: cognitive learning—gaining individual knowledge through lecture, discussion, reading, and so forth; social learning—interaction with others to build group knowledge; personal learning—building attitudes and values through enhanced self-understanding; and training—developing performance skills through structured learning and practice.

The selection of a specific learning modality for a given situation is based on two criteria: the nature of what is to be learned and the preferred modality of the learner.

HOW TKM ADAPTS TO DIFFERENT LEARNING STYLES

Because a TKM system is a technology-based learning environment, some natural limitations are inherent in the type of learning it best supports. For example, although the Collaboration Module of a TKM system supports interaction through e-mail, chat rooms, and message forums, interpersonal skills are learned best in a live, interpersonal setting. There is no replacement for the direct feedback, eye contact, nonverbal cues, and other aspects of a social environment to enhance social learning.

Accepting the natural boundaries of learning through technology, three fundamental modalities are best supported through technology-based instruction. The first modality is visual. Visual learning occurs primarily by seeing. That seeing may be a movie, animation, a picture, text, or any other form that the learner perceives primarily through the eyes. Visual learning is largely passive in that the learner receives the information but does not directly or overtly respond to it.



Visual learning is the modality we use when we read, observe the world around us, see a movie, or watch TV. The medium is fundamentally visual. It is the most common learning modality and one that works very well for most people. Some of us prefer our visual modes to be more graphic; others prefer words. Some prefer conceptual statements; others concrete. The common modality, however, is a visual reception of the information.

The second most common modality is auditory, or listening. This is primarily when we are listening to the radio or to a CD. It is the primary mode when we are listening to a lecture or speaker who is presenting from a podium. It is the primary mode when we are “listening” to a conversation with other people. Some people prefer to learn by listening. These individuals will be the first to check a tape out of the library, in preference to a book.

The third most common modality is tactile, or interactive. In this mode, the learner actively engages with the learning environment. Dialogue between two or more people is a form of interactive learning. Physically creating or building something is interactive learning. Solving a problem on the computer, in which the system is responding to your behavior, is interactive learning. Playing chess or games on the computer is interactive learning. While this form of computer-based learning takes the most time and effort to create, it is the most preferred style for most adult learners.

A comprehensive TKM system has the ability to adapt to the learner’s preferred modalities because it can do ALL of the following:

- The TKM system has the ability to build all three modalities into its learning experiences.
- The TKM system has the ability to offer all three modalities for any instructional goal.
- The TKM system gives the learner the opportunity to select his or her most preferred modality and adapts the instruction to the learner’s preferred modality.
- The TKM system also has the ability to learn which modality creates the best results with the learner—a form of artificial intelligence—and then automatically sequences its instruction so that the learner receives his or her best learning style modality first.

These elements create a fully responsive TKM system that adapts itself to the learner, rather than the other way around.

Learners want to be in control of their own learning environment—both content and modality. A TKM system gives them that control.

9. WHAT ESSENTIAL FEEDBACK INFORMATION AND REPORTS MUST A TKM SYSTEM PROVIDE?

THE IMPORTANCE OF FEEDBACK

To support the three primary audiences—learners, trainers, and organizations—described in a previous section, feedback and reports must be included as an integral part of the system.

To understand the feedback requirements, it is first important to review some of the theoretical foundations of learning information systems. This view is based on the perspective of information and control theory as applied to human social systems. The first principle of information theory is that the more and faster the information feedback, the better the control, the faster the learning, improvement, and change. Learning information systems are about continuous improvement—in rapidly changing environments—and improving the ability to satisfy our human purposes.

First, the term “information” must be defined. Information or knowledge is anything that reduces uncertainty—everything else is “noise.” Differentiating between data and knowledge is undefined in information theory, but in a popular sense, data is mixture of noise and slight information, with noise outweighing information. Knowledge or information is typically more related to something useful, has a purpose, and thereby reduces doubt. A communications scientist compares this imbalance to the simple concept of signal-to-noise ratio, with the knowledge or information being the “signal.” The higher the signal content, the easier it is to provide feedback.

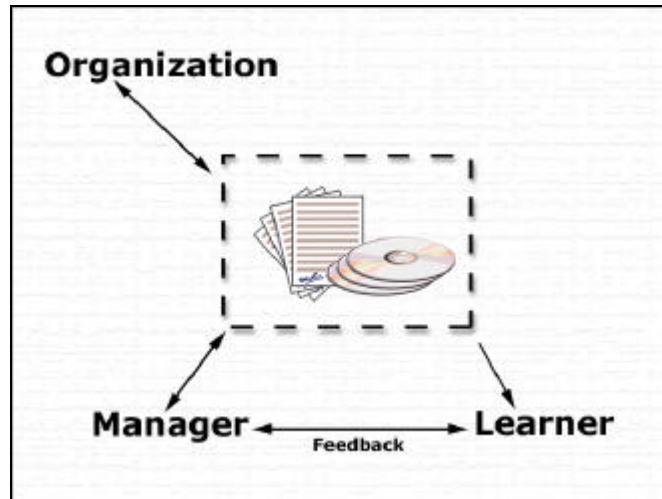
Communications scientists tend to be so focused on getting a “signal” from point A to B, they often do not understand or worry about the context or the meaning of the message. A “signal” could turn out to be just noise, if, in fact, it does not help to reduce uncertainty nor have a purpose. Norbert Wiener, the MIT mathematician who identified information and control theory as a science—which he called cybernetics, was the first to link the idea of information to both control and specific individual purpose. He defined cybernetics as the science of information and control in purposeful systems. We talk in terms of “feedback” information because the information is always a part of a control system of continuous improvement and adaptation.

One of the key things to remember is that purpose provides the context for everything. The fundamental equation for improving the “signal-to-noise”— or “data-to-information”— ratio is maximizing feedback of information in the minimal amount of time.

In human social systems, there are always multiple purposes because each person plays different roles. A TKM system is such a powerful tool because it can understand and respond simultaneously to the different purposes of three specific audiences: learner, trainer, and organization. TKM systems bring all the purposes of these three audiences or customer groups into positive alignment.

Misalignment or people working (that is, control systems working) at cross-purposes creates noise and entropy, reduces learning, and causes high variance and lack of control.

Following is a list of the key areas of feedback needed to maintain control and alignment by learners, trainers, and organizations.



FEEDBACK FOR LEARNERS

- Learners need feedback about what they must know to achieve their assigned jobs or tasks.
- Learners need to know what they already know and what skills and knowledge they have yet to learn.
- Learners need to know how well they are doing throughout the learning process, enabling them to move more quickly or more slowly, and return to areas in which their learning was not complete.
- Learners need to know when they have satisfactorily completed the process, so that they can proceed to the application of this new learning in their work.
- Learners also like to know how well they did as a student—how completely and how rapidly they achieved the specified goals compared to their peers.

FEEDBACK FOR TRAINERS

- Trainers need to know what the learners do and do not know before the instructional process begins.
- Trainers need to know what areas are of the greatest concern to the learners.
- Trainers need to receive continuous feedback to know how well the learners are learning, how complete the understanding is, how efficient the process is, what the areas of difficulty are, and whether the learners can apply the new knowledge in their work setting.
- Trainers want to know how enjoyable the experience is for their learners and what they might do to enhance the motivational aspect of the instructional process.

Trainers also want to know how well they are doing compared to their peer group. This includes how well and how rapidly their learners acquire new knowledge, as well as the qualitative and subjective feedback from the learners regarding their enjoyment of the experience.

FEEDBACK FOR ORGANIZATIONS

- The organization needs to know what is required for each major job category or set of related tasks.
- The organization needs to know the degree to which the employees in that category—as a class or group—have the required knowledge or skill.
- The organization needs to know what it will take to bring each learner up to the required or desired level of competence.

- The organization needs to know the current status of a learner or group of learners by many different categories—job category, functional group, length of employment, and so forth—and determine the status of that group.
- The organization needs to be able to recover information at the job, course, and student level regarding what training has occurred and what competence has been achieved as a result of that training.
- The organization needs to be able to develop and retain current information regarding any certification, regulatory, government, safety, or other compliance requirements regarding specific training and levels of competence.
- The organization also needs to be able to compile feedback regarding the investments for training and the returns on that investment.

All the feedback specified above is available from a comprehensive TKM system. Some of the feedback is prerequisite to training. Other feedback is formative, gathered throughout the process. The remaining feedback is summative, pulled together at the completion of the training process. Some of the feedback is individual, some by groups identified in multiple configurations, and some for the entire organization. All of these different types and points of feedback—at learner, trainer and organization levels—are required to provide a responsive system that is constantly adapting to changing requirements. While this amount of data would be overwhelming through traditional methods, it is an integral and automatic part of a complete TKM process, thereby enriching and accelerating learning throughout the organization.

10. HOW DOES A TKM SYSTEM SUPPORT BOTH INDIVIDUAL AND GROUP LEARNING?

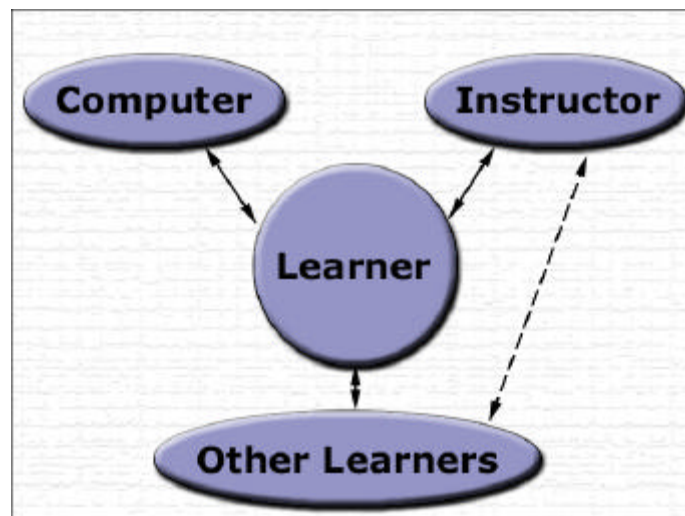
Ever since technology was introduced into the learning process, many different forms of media and technology-based instruction have been hailed as the panacea or breakthrough to change the basic structure of education. Yet, the classroom remains the dominant form of instruction—and for good reason.

Computers were identified as the breakthrough learning tool as early as the 1950s. The era of programmed instruction followed—using both paper-based and computer-based models. Many of us can recall the arguments that raged during the 1960s between linear and branching-type programmed instruction as instructional media and principles of ISD first came into practice. Many other forms of media have followed—videos, endless loop learning cassettes, CD-ROMs, and now the power of the Internet to provide on-line learning.

Each new use of technology has been hailed as the formula to truly change the fabric of the instructional process. And each has ultimately fallen short of its initial high expectations, while remaining as a valuable tool in the educator's arsenal of learning support systems.

The reason that no technology-based learning system can provide the complete answer is that learning is not solely an individual, linear process. Some forms of learning occur individually. Others occur in a group setting. Some occur in a formal training process. Others occur informally, directly in the work environment.

The best form of learning at any given moment in time is based on multiple factors—including the nature of the knowledge to be learned, the learning styles and preferences of the learner, the availability of resources, and the learning environment. This means that a true TKM system must be able to support *both* individual and collaborative—or group—learning.



The common base of a TKM system that supports both individual and collaborative learning is the Development Module. This module enables all the content and learning objects to be placed in one central relational database. This content database can then support individual training, classroom and collaborative learning, knowledge management, and performance support.

INDIVIDUAL LEARNING SUPPORT

At the individual level, the TKM system offers both structured training and knowledge management through its Distance Learning and Electronic Performance Support System modules.

In addition to direct delivery of instruction over Internet and Intranet lines, the TKM system—through the Publisher Module—also enables instructional content to be converted to other forms of media, such as CD-ROMs for delivery to individuals who do not have Intra- or Internet access.

COLLABORATIVE LEARNING SUPPORT

A TKM system also has a variety of vehicles to support collaborative—or group—learning. First, a TKM system includes a direct e-mail connection to the instructor or “content expert” for each category of instructional units or modules. If a learner has a question regarding the instructional information, he or she can be connected directly to the designated content expert for that field. Responses can be set in a variety of ways, including general availability, set times for responses (remote office hours), guaranteed response times, and so forth.

In addition, a TKM system includes an open chat room and a message forum for every designated course or group of related courses. All the learners who are actively registered in a course (whether they are online at that moment or not) can exchange questions, answers, ideas, and information about the course.

Other groups of related interest groups also can be established to support group learning.

The Collaboration Module of a TKM system also includes the capability for streaming media. Large media-based messages can be communicated across an organization. For example, a speech from a chief executive officer, a large conference, a stockholder’s meeting, or a message from a school superintendent can be made available using streaming video technology, so that everyone can pick up the message.

CLASSROOM LEARNING SUPPORT

A TKM system also provides the paper-based output needed for classroom-based instruction. Teacher manuals and guides, student manuals and texts, overheads, and lesson plans can all be retrieved from the Publisher Module, so that the same content base can fully support classroom instruction.

The Management Module supports registration and scheduling requirements for both individual and classroom instruction. The record-keeping component of the system fully records and supports course completion, grades, and certification from all instructional modes.

Through the use of one common knowledge repository, combined with the use of technology to deliver that knowledge through a wide variety of distribution channels, a TKM system can provide full support for both individual and collaborative learning.

SUMMARY

TKM—Total Knowledge Management—is both a philosophy and a technology. It represents significant opportunities for corporations to achieve breakthrough competitive advantage and for educational institutions to significantly accelerate the learning process.

The classroom is one of the few aspects of life that has changed very little over the past two thousand years. Our ancestors of two thousand years ago would be astonished if they visited our world today. The buildings in which we live, the communications systems, automobiles, television, airplanes, industries, cities and the like all reflect astonishing global technological development and industrialization.

Yet, these same ancestors might breathe a sigh of relief if they were to enter a classroom. Here, at face value, very little has changed. The teacher still stands in front of the classroom and learners still sit in their seats, listening, taking notes and asking questions. Plato or Socrates would still be at home.

Underneath these apparent similarities, however, significant alterations are also occurring in the learning landscape. We know a great deal more about how individuals learn and what makes effective instruction. We are also able to apply increasingly powerful technological resources and tools to enhance and accelerate the learning process.

TKM is a technological breakthrough—and may have a level of impact that is just beginning to be imagined.

Most change is evolutionary. We continuously refine and advance our knowledge and our ability to apply that knowledge. Some change, however, is discontinuous. Discontinuous change is often referred to as a breakthrough—or a change in paradigms. It means that the fundamental rules that govern our understanding of the world and our ability to control that world have been changed, allowing for new realities that previously would have been impossible to achieve.

Examples of discontinuous change in our century have included the invention of mass production and the assembly line, the automobile, the telephone, television, the airplane, the transistor, and the computer. Each of these breakthroughs has fundamentally changed our lives and our society.

Today we are at the early stages of another major discontinuous change—the Internet. This change holds the promise of creating a world that is truly a global village, and one in which all people can be equal—endowed with the same ability to access and share vast amounts of information instantaneously.

For the private sector, this will shift the definition of competitive advantage. Tangible capital, goods and services are already being replaced in many industries with a new advantage—collective information (organizational learning) that can be shared and accessed equally by all employees to bring the full power of a company to every customer through every employee.

In the public sector, this same tool opens the doors for equal learning for all students.

The technological vehicle that enables the Internet breakthrough to be applied to learning, training and organizational knowledge is TKM – Total Knowledge Management. Generation21 Learning Systems is proud to be at the forefront of this technology and bring the attributes of masterful teachers to everyone – helping to make a knowledge driven society one of the standards of the world of the future.

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APPENDIX A

THE MASTERFUL TEACHER

Educators have many names. In the school environment, we call them teachers. In higher education, they are known as instructors or professors. In the corporate environment, they are trainers. Still other educators are known as coaches, mentors, managers, bosses, parents, and friends.

Regardless of the name, masterful teachers have a unique set of abilities and approaches that they use with learners. They often use their skills unconsciously—barely aware that they are continuously modifying and adapting the learning situation to the needs of their students.

We have studied and analyzed some of the key skills and attributes of these masterful teachers. The purpose was to design a technology-based system that incorporates as many of these key attributes as feasible in a learning environment in which the teacher is not present.

The purpose is *not* to replace classroom instruction. After all, one of our key learning principles is that learning occurs in both individual and group environments. We also believe that teachers and technology working together are essential in creating breakthrough results. The purpose of this analysis was to incorporate as many as possible of the differentiating behaviors of the masterful teacher into the technological system.

Following, are some of the key attributes of masterful teachers and the implications of these behaviors for corresponding technology-based learning systems.

MASTERFUL TEACHERS ARE CONTENT EXPERTS IN THEIR AREAS OF EXPERTISE.

Masterful teachers have a greater depth of knowledge about their subject matter than they deliver to the learner. This knowledge provides teachers with a wealth of background information that they can share with their learners. Masterful teachers can answer the penetrating questions asked by their more insightful learners, and place their current instruction in the broader, deeper context of their subject matter.

Implications for a TKM system

Technology-based learning systems should contain a repository of information that goes beyond what is contained in the lesson being presented to the student. This information should be built into the curriculum as more in-depth knowledge that can be accessed by the insightful learner. This additional information may be contained in a separate repository of information that can be accessed by the learner in much the same way that classroom learners use an encyclopedia or reference manual for more information.

MASTERFUL TEACHERS ARE CLEAR ABOUT THE GOALS OF THEIR INSTRUCTION.

Masterful teachers begin with the end in mind. They know the results they want to achieve from their instructional process. Whether building cognitive understanding, values, or performance skills, teachers are clear about the intent of their instruction. They design the instructional content and process to work toward that goal with pinpoint accuracy. Masterful teachers do not stray from the course of a lesson unless the question or side conversation is building on or reinforcing the instructional goal. Masterful teachers manage time carefully and are attentive to their instructional goals. Watch the tennis pro at work with her learner. She might say, "In our 45-minute session today, we are going to learn how to properly execute a backhand swing and practice that swing from the baseline." The music teacher might say, "Today we are going to learn the C major scale." The industrial trainer begins, "In this lesson, you will learn how to disassemble, adjust, and reassemble a laser printer."

Implications for a TKM system:

Technology-based learning systems, should start each learning session with a clear goal or instructional outcome. The subsequent learning activities should be designed to build knowledge and skills toward the attainment of that goal. Instructional Systems Design (ISD) methodologies ensure that the curriculum developed is explicitly derived from and builds back to the desired learning outcome.

MASTERFUL TEACHERS LISTEN TO THEIR LEARNERS AND BUILD THEIR INSTRUCTION BASED ON WHAT THE LEARNERS ALREADY KNOW.

Each learner is unique and has an individual set of learning needs that are based on what the learner needs or wants to know at a given moment in time. For the adult learner in a work environment, these needs are based on job requirements. For the student in a classroom, these needs are based on the goals of a course or a set of standardized requirements from a defined curriculum. In some cases, such as individual coaching, learning requirements may be more personalized.

The context of the learning defines half of the learning requirements. The other half of the learning requirements are based on what the learner already knows. Reteaching what the learner already knows has little value, unless the reteaching is a brief review to set the stage for new learning. The older we are, the more life experiences we have had and the more we know about many things. As a result, adult learners have less tolerance for highly structured classroom situations. They already know a great deal about many subjects and would rather learn through practical experiences and "hands-on" applications, using what they already know and building new knowledge and skills from their current platform of understanding. Masterful teachers approach each learning experience with an in-depth understanding of their subject and a clear instructional goal. These teachers adapt and modify this content based on the needs of the learner at that moment plus an assessment of what the learner already knows.

Implications for a TKM system:

Technology-based learning systems should have the ability to build a wide variety of courses and instructional programs based on the differing needs of classroom learners and differing job requirements of adult learners. This same system should also have the further ability to dynamically adjust and modify that instructional program based on what the learner already knows, building on existing knowledge and skills. This approach is both more interesting for the learner and more

efficient for the learning process.

MASTERFUL TEACHERS CONTINUALLY MEASURE AND MONITOR THROUGH FEEDBACK AND MAKE ADJUSTMENTS BASED ON HOW WELL THE LEARNER IS DOING.

Masterful teachers use a continual, unconscious assessment as they teach. They monitor continuously and slow down, speed up, take diversions, build examples, develop applications, and make other accommodations so smoothly that the adjustments seem like a normal and natural part of the learning process. Sometimes the assessment is direct, such as asking specific questions and listening to the answers. Other times, the instructor makes adjustments based on questions asked by the learners or responds to the blank stare, the confused look, the unsure answer, the inappropriate response, or other verbal and nonverbal cues that learners continuously express.

Masterful teachers absorb this feedback unconsciously and know when to proceed more quickly when the learner or group has clearly grasped the new concept, to slow down as required, to build practice, to take a time out, and so forth. This continual adjustment is automatic and dynamic and is seen at its highest level in the one-on-one tutoring situation. For example, the unconsciously incompetent lecturer in front of a large audience simply drones on and on, regardless of the learning that may or may not be taking place. The masterful teacher, on the other hand, is responsive to every question, nuance, and cue from the learners.

The masterful teacher must have extensive knowledge and a multitude of skills to both “read” the situation and to accurately gauge the learner’s response—and then to instantly modify and accommodate instructional content and methodology based on that feedback.

Implications for a TKM system:

Technology-based learning systems must have the ability to solicit feedback from the learner through a live, interactive method and then dynamically adjust content and instruction in an ongoing manner based on that feedback.

MASTERFUL TEACHERS USE A BLEND OF INSTRUCTIONAL METHODOLOGIES.

Most of us have taken a course in which the teacher used exactly the same style or method every day. Large lecture halls in college are a good example of a singular instructional method. The learning experience eventually becomes boring, even if the content varies and is interesting. To facilitate learning, students crave variety, want multiple senses impacted, and appreciate diversity.

Masterful teachers transition easily from large, class activities to work in smaller groups and to individualized instruction. Some students engage in projects; others read and write in small groups or alone. Discussion becomes an exercise, and perhaps, a short quiz is given to assess the learning that has occurred. The blending of instructional methods adds rhythm and variety to the learning environment. The selection of which method to use at a given time is based on the nature of the content, the preferred style of the learners, and the desired outcomes. Masterful teachers blend these variables into a rich classroom experience that enhances learning and creates a highly motivating environment.

Implications for a TKM system:

Technology-based learning systems need to have the ability to deliver multiple learning methodologies and to switch methods based on content, the learner, and the specified instructional activity.

MASTERFUL TEACHERS ADAPT THEIR INSTRUCTIONAL METHOD BASED ON LEARNER FEEDBACK.

People learn differently. Recent research by Howard E. Gardner (*Multiple Intelligences: The Theory in Practice*, 1993) has identified at least seven different types of intelligence. Some people learn best by listening, others by talking. Some learn best by watching, others by participating. Some are visual learners, others are tactile learners. Masterful teachers determine which style works best for a learner and then adapts his or her instructional method for that learner or group of learners.

I recall a favorite high school physics teacher, who was vainly attempting to describe to us how electrons circle around the nuclei of atoms and then bump into one another to create new molecular structures. We just did not get it! The teacher then had us stand and had groups of students represent the parts of molecules. Some students were electrons; we physically “bumped” into one another. The class was riotous; we all had great fun. Forty years later, I still remember the lesson. This masterful teacher adapted his initial style—lecture and chalkboard illustration—to a more interactive, physical demonstration that was just what was needed for the situation.

Implications for a TKM system:

Technology-based learning systems need to contain multiple learning methodologies and have the ability to change methods based on demand by the learner or automatically based on learner feedback and success.

MASTERFUL TEACHERS USE MANY RESOURCES TO ENHANCE THE LEARNING PROCESS.

The world contains a rich array of resources available to support the learning process. The knowledge of the teacher plus books, films, videos, library resources, community resources, field trips, and so forth all facilitate learning. The masterful teacher seeks out and uses these resources. To provide the greatest variety and depth of knowledge and information for the learner, the masterful teacher fills his or her classroom with a broad array of resources, including access to individuals throughout the community.

Implications for a TKM system:

Technology-based learning systems, need to have direct links to the array of resources contained within an organization, as well as ease of connectivity to these resources on demand, for use when the learner has the need and the interest.

MASTERFUL TEACHERS ARE DEEPLY COMMITTED TO THEIR LEARNERS.

The greatest gift that masterful teachers give to their students is the gift of caring—caring about the learner and about whether the learner is assimilating the concepts being taught. When people are asked about the

teachers who have had the greatest impact on their lives, they often respond with statements such as, “That teacher really cared about me and sincerely wanted me to learn. She was there for me, and her act of teaching was a gift.”

Implications for a TKM system:

Technology-based learning systems cannot match this precious gift. These systems must be responsive to the learner and the learner’s needs. But, they cannot replace the personal relationship that often develops between teacher and student. As a result, we continue to believe that technology and teachers working together are the essential combined resource that is necessary to create breakthrough-learning results.