

Learn More, Train Less:

The Case for KnowledgeWebs

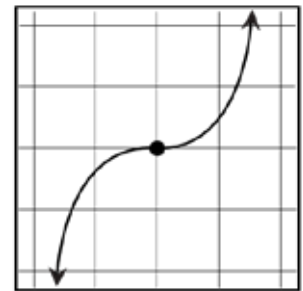
A RDC Whitepaper

Training and knowledge management in the process manufacturing industry have reached an inflection point—one that has been approaching with increasing speed over the past 30 years.

When Silicon Valley approached a similar situation (although attributable to different forces), Andy Grove of Intel captured the essence of the situation when he said: “an inflection point occurs where the old strategic picture dissolves and gives way to the new. It is the point where a new paradigm kicks into overdrive and the old ways of doing things quickly fade away.” This inflection point will have a profound impact on the ability of manufacturers to operate efficiently, safely and profitably in the future.

Process Manufacturing’s inflection point is the inability of the traditional training model to meet the increasing knowledge transfer challenges the industry faces today—challenges directly attributable to four new megatrends that are now converging on most process manufacturers like the perfect storm.

1. The attrition of the skilled workforce as baby-boomers retire from the workplace in unprecedented numbers,
2. the driving need to leverage company- and industry-wide best practices in response to both consolidation and expansion and the need to optimize operating efficiencies,
3. the constantly changing and increasingly burdensome compliance mandates that are overloading the limits of the current training infrastructure, and
4. the industry-wide shortage of skilled resources (both trainers and trainees) which is straining the current training paradigm to its breaking point.



Process manufacturing's inflection point is the inability of the traditional training model to meet the challenges the industry faces today.

The Training Dilemma

According to the U.S. Department of Labor, 70 percent of all training in the workplace is informal. New hires or transfers are assigned to a job, and are shown the tasks and procedures they must know by a senior worker or supervisor. If something outside of their day-to-day responsibilities comes up, they again turn to that senior associate for the additional knowledge they require.

This is often the case in the process manufacturing industry. While substantial formal training clearly exists, much of the real learning is done on the job, passed informally from those who know—to those who need to know—when they need to know it. This is a system that has worked well for the past 50 years. But as we begin the second decade of the 21st century, the need for optimal knowledge transfer will be greater than ever before. In 1982's bestseller *MegaTrends*, John Naisbitt states: "We are drowning in information, but starved for knowledge. The quantity of available information is clearly impossible to handle with present means. Uncontrolled and unorganized information is no longer a resource in an information society, instead it becomes the enemy." And things have gotten worse. According to IDC, "the amount of digital information created, captured, and replicated in 2007 was 281 exabytes...more than 5 million times the information in all the books ever written. By 2011, the digital universe will be 10 times the size it was in 2006." Naisbitt's prophecy has never been truer. Similarly, the information required for each person's job is increasing exponentially. Changing environmental constraints and constantly increasing product demand place new pressure on the workforce to stay current, while the relentless search for profits in an ever-more complicated global industry demands unprecedented responsiveness and efficiency to cost effectively capture and transfer knowledge.

Unfortunately, today's training paradigm is poorly equipped to meet these new and complex knowledge transfer requirements.

The Perfect Storm

At the heart of each of these megatrends is a common thread: knowledge... who has it, who needs it, how it is accessed and, how it can be effectively transferred throughout the enterprise. For example, when experienced workers leave, their accumulated knowledge leaves with them—unless there is a process to capture their knowledge in a way that facilitates its transfer to other employees throughout the organization. Similarly, best practices cannot be deployed unless the underlying knowledge they are based upon is captured, vetted, organized and transferred effectively. The intent of compliance mandates (which are all job-specific) cannot be achieved, nor the number of incidents actually reduced, unless the requisite knowledge is, in fact, transferred to the worker—simply conducting training won't get it done. And all of this must be accomplished with fewer trainer and trainee resources.



"We are drowning in information, but starved for knowledge."
~John Naisbitt

1. Skilled Workforce Attrition

To understand the impact of skilled workforce attrition, simply look at hiring patterns over the last 30 years. Up through the early 1980s, many process manufacturing industries were enjoying strong sales and profitability. Older retired workers were replaced by new hires, and explosive growth led to further expansion of the ranks. There was a steady supply of workers across all skill/knowledge levels of all jobs.

Then came the down times of the 1980s and the early 1990s as economic pressures led to layoffs and hiring freezes. Workers left and were not replaced. Instead, more was done with less, and the company's knowledge, skills and experience was condensed into an unnaturally small workforce with one thing in common—they would all soon retire. The group behind them, who would normally be the custodians of the enterprise's knowledge, was never hired. Instead of spreading and protecting institutional knowledge and experience across several generations of workers, it was now unnaturally concentrated in the older workers—and that knowledge and experience will leave as they retire.

Companies in the chemical processing industry alone expect to replace 75 to 90 percent of their skilled workforce over the next 10 years. Other process manufacturing industries face similar challenges. There is a real concern that knowledge will walk out the door when senior workers retire—and that it may have to be re-learned and/or re-created at consultant rates, as has happened in other manufacturing industries. The institutional knowledge of the industry is at risk of being lost—potentially forever.

Unfortunately, the traditional training paradigm cannot solve this problem.

2. The Need for Best Practices

There are wide-ranging performance differences between similar units at different plants. Safety records vary significantly between plants even when they follow the same training curriculum, and productivity often varies even between units with the same design license. The need to discern, document and deploy best practices, whether developed within the plant, the company, or as part of a larger industry initiative, is crucial for safe and efficient operations. Yet this centralized base of knowledge rarely exists.

Part of the reason for this is that in the absence of an overt directive to extend best practices throughout the enterprise, groups within the company developed their own ways of doing things and were satisfied with “what worked” for their site. This has led to operational inefficiencies, especially given the level of industry consolidation over the past few years. Workers transferring from one unit to another, for example, may find that things are done differently in the new unit, despite the fact that both are part of the same company. When that happens, retraining of experienced workers is required—and the new procedure may not necessarily be the better procedure. The challenges of maximizing profits, consolidating multiple and often conflicting



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procedures, and reconciling cultural issues brought together by globalization make it even more important to standardize and deploy a single set of best practices.

Even when a proven “best practice” does exist within the company, it is seldom documented, organized and pushed-out to benefit all corners of the enterprise. The simple fact is that few companies have the resources, time or focus to deploy best practices at the operational level, let alone the expertise, tools and technology to define and deploy them at the knowledge transfer level.

Yet, the need to manage best practices grows dramatically.

3. Compliance Mandates

Mandates cut with a double-edged sword.

The first cut confronts process manufacturers with some of the broadest and most stringent health, safety and environmental regulations of any industry.

The second edge cuts with the complexity of constant change. Simply put, compliance mandates don’t happen on a convenient schedule. The ever-changing business, political and environmental landscape can test the limits of even the most agile organization’s knowledge infrastructure, making it difficult for companies to proactively go beyond the letter of the mandates to create the levels of advanced knowledge that can actually produce measurable safety and operating improvements.

Constantly changing and increasingly burdensome compliance mandates challenge an organization’s ability to keep their workers in compliance. Too often, process manufacturers struggle just to meet the minimum requirements even when a broader curriculum can be shown to have a positive impact on the business.

4. Training Resource Limitations

Clearly, the need for training is growing. Even the budget for training is growing. But there are too few resources on both sides of the equation—too few trainers and too few trainees. In fact, Strategy+Business magazine states “from rig workers to petroleum engineers, there’s more work to be done than there are workers to perform it.” Further, ASTD cites that the average direct learning expense per employee has risen nearly 40% since 2000, to \$1,103 per year, proving that employers realize the need to increase employee knowledge levels and are willing to invest to do so. Despite this fact, training managers and human resource professionals find themselves under increasing pressure to do more with less and to do it better.

The rapidly-changing nature of the process industries further complicates matters. As new procedures, best practices and government mandates are introduced, training programs must be altered quickly to incorporate this new knowledge. Many companies find it difficult to keep their materials



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up-to-date, or to design programs that fit the knowledge and experience level of the people using them. Few companies have the resources to meet these demands, much less exceed them. Even some of the world's largest enterprises who have invested in global training centers with the ability to train 10,000 students annually struggle with rationalizing their training materials and curriculums, finding qualified instructional designers and other learning experts, attracting new talent and retaining that talent.

All of this has placed an enormous burden on the current training paradigm. Economic pressures have made it even worse. As managers are challenged to maintain profitability and efficiency with a shrinking workforce—and trainers are struggling with limited resources—and workers are asked to do more and more—the justification to increase the time spent on training is difficult at best...even when it can be shown to positively improve performance and profitability.

Each of these megatrends further complicates an already complicated environment. An unhealthy amount of institutional knowledge has concentrated in the senior workers and the impending attrition of the current skilled workforce as baby-boomers retire, portends a “chicken and egg problem” of monumental proportions. Best Practice deployment is sorely needed to wring-out every operating advantage in the face of constantly increasing global challenges. But, the limited ability of traditional techniques to successfully capture, consolidate, refine, manage and deploy Best Practices raises this question: Will the industry choose to proactively address this need in the face of other equally critical ventures? Compliance mandates are only a part of the total knowledge required for safe and profitable operations, but they often represent a significant part of an employee's total training. A better way to address compliance as part of the constantly growing training requirement is needed. Unless a new way of recruiting or a new source of qualified workers can be found, the shortage of skilled training resources may turn out to be moot.

Clearly, the eye of the perfect storm seems to be squarely upon us.



A New Look at Training

Training—or more appropriately, learning—will be a deciding factor and competitive advantage throughout the 21st century. If, as Andy Grove says, “at the inflection point, the new paradigm kicks into overdrive and the old quickly fades away”, it seems obvious that the training paradigm must change now. The answer isn't as simple as doing more of the same. We must create a solution that is more comprehensive and more flexible than anything that has been previously available—one that addresses the three variables that determine the success or failure of the knowledge transfer process: the content, the delivery and the learner.

The New Paradigm—Learning Optimized

Any new paradigm must fully address these three variables. If this new paradigm is to “kick into overdrive”, it must address each challenge by offering new ways to structure learning content, to deliver training and to accommodate each learner’s unique needs. Generic training cannot eliminate these variables nor can it address the two fundamental precepts of adult learning in the workplace: 1) only train the learner on what they need to know to do the job and 2) do not train them on what they already know.

Specifically engineered to purpose, a KnowledgeWeb™ can do all this and can even change the fundamental metrics of success by measuring learning—that is by measuring knowledge levels and knowledge transfer instead of simply recording training.

To expand on Naisbitt’s famous quote, it is a common misconception that data is knowledge. But for data to truly become knowledge, it must first be converted into information and then successfully transferred to a learner. That is the purpose of a KnowledgeWeb .

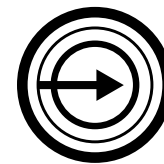
A KnowledgeWeb is an optimized learning environment that transforms data into information and information into knowledge. It is a knowledgebase of all information required to fulfill any learning initiative related to any equipment, process, system or product, in any environment, specifically engineered into validated Microcourses™, which in turn are mapped to site- and job-specific knowledge requirements. The result is a closed-loop environment that can dynamically create a Personal Learning Path for each worker and measure learning in order to certify 100% proficiency.

KnowledgeWebs V. Training Variables

Engineered KnowledgeWebs eliminate two of the three variables, by providing consistent, high quality content and delivery, while accommodating the one variable that can never be eliminated—the Learner. In doing so, the KnowledgeWeb minimizes variability and increases consistency by engineering a “closed loop system” that transforms data into information, and information into knowledge.

The Content

Most process manufacturers have a surplus of training content. Some of it has been consistently updated while some of it is old and out-of-date. Some was developed by independent third parties while some was designed by in-house staff. Some employ a sound instructional design methodology while some simply make an attempt. And some are generic, while some strive to comply with the site and job-specific requirements described in the mandates. Unfortunately, most job curriculums result from a best-efforts attempt to combine these disparate “courses” into a meaningful representation of the job’s true knowledge requirements.



KnowledgeWeb minimizes variability and increases consistency by engineering a “closed loop system.”

While this approach may have sufficed in the past, it is clearly inadequate to meet the growing needs of the industry's future. Why? Because it is based upon an inaccurate definition of each job's specific knowledge requirements and because unacceptable quality variables are inherently built-in to this model from the start.

Engineered KnowledgeWebs begin in a fundamentally different place. While standard training materials can be helpful to communicate concepts, the total knowledge requirements for any job are never fully covered in a training course or courses—they are often only in the minds of the unit supervisor(s) who too often subjectively decide what learners need to know. KnowledgeWeb engineering begins by working with these subject matter experts (SMEs) to objectively define explicit knowledge requirements for each job. A job's knowledge requirements are absolute and reflect all the knowledge that is required to perform the job including: basic core competencies, technical skills, HS&E topics, refinery fundamentals and many more. Through disciplined data acquisition and "scrubbing" techniques, KnowledgeWeb engineering captures and "cleanses" this undocumented data that is part of an institution's collective knowledge. Out-of-date material is purged, duplicate information is consolidated, missing elements are supplemented and the result is distilled down to the site-, unit- and job-specific level. The engineering process also looks at company and industry best practices as well as government mandates to achieve a comprehensive 360 degree view.

Once the raw data have been captured, a structured instructional design methodology is followed to ensure that learning content is modularized into Microcourses™ to meet specific learning objectives. In addition to ensuring that each and every learning objective is specifically addressed, Microcourses can be automatically combined and recombined in real-time with other Microcourses to form truly unique personal learning paths (see Mastery Assessments and Differential Learning below). The Microcourses are validated and the process of transforming data into information is complete. Each job's knowledge requirements are defined and documented, the subject matter expert's knowledge is captured and the variability of the learning content is eliminated.

The Delivery

In a traditional training paradigm, delivery is often performed by an instructor, typically a supervisor (who may be an SME, but who is seldom a professional trainer) charged with multiple duties. Even when instructors work from the same materials, human nature dictates that each will interpret them differently. In these cases, the instructor himself adds an unmanageable variable to the equation. Some may focus heavily on one area and less on another, while others approach the topic from the opposite direction. Each instructor will determine what is critical to cover in-depth and what can be glossed over based on their own experiences...experiences that vary as much as those of the learners.



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An additional challenge to traditional training delivery is that classroom-based training is very difficult to tailor to the needs of multiple learners. To meet the intent of all mandates, training must be job-specific. This requirement poses an impossible burden on classroom training. Obviously, classroom training materials cannot be cost-effectively developed and delivered for each job on each unit. It is equally as unlikely there are enough candidates from a single job to fill the class, and if there were, the time and effort of customization is prohibitive.

KnowledgeWebs not only facilitate site, unit and job-specific customization, they actually depend on it. Unique tools are used to extend the base Microcourses with site, unit and job-specific variables that meet the mandated specificity requirements and the explicit requirements of each job.

The KnowledgeWeb ensures that custom content can be developed and maintained as easily as off-the-shelf- generic content and that delivery variables are completely eliminated. The KnowledgeWeb also allows the trainer to refocus their efforts on skills demonstration, which is much better suited to the classroom environment and less sensitive to delivery variables. The focus is on assessing that the skill has been learned as opposed to teaching the knowledge.



KnowledgeWeb targets site, unit and job-specific knowledge requirements.

The Learner

One thing seems certain: workers in a plant often have little in common other than the similar jobs they hold. They have different backgrounds, interests and learning styles. They went to different schools and received different degrees. Some have been working for only a few years, others for much longer. A few are on their way up...others on their way out. All you need to do is guarantee that each and every one of them is 100 percent proficient on his or her unit and in his or her job. Anything less creates a potential liability both for the company and its employees!

How do you reach this goal efficiently given their individual differences? Traditional training cannot accommodate the endless differences in your workers' backgrounds, learning styles and current knowledge levels. Traditional training courses provide instruction regardless of the current knowledge or experience level of the learner. They follow a pattern of A to B to C without consideration that the learner may have already mastered A and a portion of C. Even adaptive learning models can only 'adapt' at the relatively broad course level.

KnowledgeWebs, on the other hand, are infinitely adaptable thus enabling the creation, for the first time, of true Personal Learning Paths. This is accomplished through Differential Learning™ which tailors the knowledge transfer process for the one variable that can never be eliminated—the learner.

Differential Learning is the final step in the process of transforming data into information and information into knowledge. It begins by measuring

the learner's proficiency against the total knowledge requirements of his/her job with a Mastery Assessment of their current knowledge level. Mastery Assessments can determine existing knowledge by measuring against broad concepts (i.e., terminal objectives) instead of traditional evaluations (tests) which measure relative to individual learning objectives. A mastery assessment reduces the evaluation process by about 80% compared to traditional "final" evaluations.

The purpose of Mastery Assessments is to be sure that time spent in learning is focused only on what the learner needs to know and that he/she does not already know, rather than spending time going over material he/she mastered long ago. If there are gaps in knowledge, it is better to find and remediate them now rather than discover those gaps after problems arise, particularly in the dangerous environment of the process manufacturer. KnowledgeWebs provide the cost-effective means to do so.

Once the individual's unique knowledge gaps are identified, a Personal Learning Path is dynamically and automatically generated to close those gaps. Rather than following the 'A to B to C model,' Differential Learning excludes any areas where the learner is already proficient and remediates the topics where he/she is not.

For example, suppose a job requires the ability to perform basic math calculations. It would be a waste of both the learner's and the company's time to be trained on basic math skills when he/she can already add, subtract, divide and multiply at a high school level. Instead, having demonstrated math proficiency at the required level, Differential Learning moves that learner to higher level math operations.


The net result is a situation-specific approach to learning that very closely mirrors the learner's experience in the real world. The choice regarding which knowledge to transfer is not left up to the discretion of a supervisor who determines what their operators need to know, or even the learner themselves. All knowledge needed for the job, as well as the unit and site (including best practices and compliance mandates), is conveyed to every worker. And it's accomplished at a pace that suits each learner, with 100 percent measurable reliability. It's a focused approach that uses time and resources far more efficiently.

Differential learning can actually increase learning by reducing training.

Knowledge Engineering as a Hiring Tool

While KnowledgeWebs are primarily designed for learning, they can also be used for other purposes. For example, by measuring the existing knowledge level of workers throughout the company, human resource executives can identify patterns that lead to better hiring. By reviewing the scores of high achievers with a year or less on the job, recruiters can administer the same test to potential new hires to determine if they possess the same skills.

Executives can also measure one site against another to determine if workers



An individual's unique knowledge gaps are identified, then a Personal Learning Path is dynamically generated to close the gaps.

at a particular site are coming in with better skills or are being trained better than at a sister site, and then implement the findings to improve success levels across the company.

The key is having the collective knowledge of the organization captured and quantified so it can be used as a baseline, and having a knowledge assessment mechanism that reflects the real world of the job's knowledge requirements rather than the generalized objectives of traditional curriculums.

Conclusion

As process manufacturing industries emerge on the far side of the training/knowledge transfer inflection point, there is an urgent need for KnowledgeWeb engineering to capture, quantify and transfer knowledge before it leaves the workforce. As industry consolidation and government intervention continue to gain momentum, this urgency is greatly increased—especially in light of well recognized training resource limitations, which make it more and more difficult to support the traditional training paradigm.

KnowledgeWebs solve these issues by capturing the collective institutional knowledge of an organization's subject matter experts and wrapping it in a delivery system that is tailored to the needs of each individual, while fulfilling the needs of the organization. By measuring what the learner knows against all the knowledge required for the job, Differential Learning techniques can dynamically and automatically develop an objective, Personalized Learning Path that is site-, unit- and job-specific, and that will yield 100 percent mastery for every worker. The result is a safer working environment, greater operational efficiency, reduced liability, greater profitability, and a tangible ROI.

1. IDC, The Diverse and Exploding Digital Universe, 2008

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About RDC

Resource Development Company (RDC) is a global leader in developing innovative learning solutions. For the past 50 years, they have specialized in providing learning solutions to the oil and gas, refining, chemical, petrochemical and pharmaceutical industries. Extensive industry knowledge and advanced web technology allow RDC to deliver unparalleled learning management, performance support and compliance information management solutions. For more information, call +1 (800) 360-7222 (in the US), +1 (248) 646-2300 (international) or visit www.rdc.us.com.



KnowledgeWeb is tailored to the needs of the individual, while fulfilling the needs of the organization.

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