Situated Learning

New approach to SH&E training focuses on learning

By David Machles

We can be knowledgeable with other men's knowledge but we cannot be wise with other men's wisdom.
—*Michel Montaigne, essayist (1533-1592)*

MANY METHODS USED to conduct SH&E training in today's workplace are based on a traditional transmission perspective of teaching using objective-based instructional design. This article examines that paradigm from a learner's perspective and offers an alternative approach to SH&E training.

To understand how the transmission paradigm has become established, one must understand the roots of the SH&E profession. The profession began during the industrial revolution with the focus on safety design or engineering. The role of employee education was considered secondary because safety could be engineered into the design of the machine, meaning the human aspect could be largely ignored.

Gradually, the role of teaching or training became important as people needed to know how to work safely in their environment. With a background in engineering or similar science, however, SH&E professionals were not hired for their training or counseling skills, but for their expertise in safety (Pratt 63). Content experts are generally most comfortable with the transmission method of teaching and training. In this model, the teacher (the content expert) transmits the information to the student who accepts it with little question. The goal is to move the content or knowledge from teacher to learner (Pratt 65).

This method has long been used to deliver most SH&E training. If employees need to know how to properly use a machine guard, recognize the hazards of a particular chemical or how to properly insert hearing protection, then transmission of information is considered appropriate. This method provides well-structured content—explicit teaching subject matter for hierarchal learning, which is built on prior knowledge in a step-by-step manner. Math, grammar, plumbing and electronics are other examples of well-structured content areas (Pratt 66); as a science, safety fell into this category.

Since the SH&E profession is built on a framework of engineering or science, the transmission perspective is also well within the comfort zone of those doing the teaching. Trainers and SH&E professionals can take this well-structured knowledge and break it into bite-sized pieces, then design the course in a way that transmits the information to the student (Figure 1). Typical transmission methods include lectures, videos, guided instruction, group discussions and computer-based training. If designed correctly, these programs are objective-based—with objectives and goals clearly defined by the instructor or teacher (Pratt 66). The expectation is that once the instructor transmits the information to the learner, s/he will incorporate or transfer this knowledge into the workplace. As SH&E professionals know, however, it does not always work that way.

Problems with Transmission Perspective

According to Pratt, "the problem with transmission teaching is that it creates difficulties in regard to transfer." In other words, the content may not move to the learner, then on to the work setting. Perhaps the information was delivered in chunks that are too large or contain too much information. The training may lack proper support due to insufficient practice. If the material is taught only once, comprehension problems may occur. And, learners may not participate as fully as the teacher expected (Pratt 75; Broad and Newstrom). In the author's experience, the added pressure to make sure the information provided fulfills regulatory requirements is another factor. This often results in delivering more information than the learner can use or "just in case" information.

Transfer continues to be a major obstacle. Certainly, telling employees what could happen if they

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work in an unsafe manner should motivate them to perform safely. Unfortunately, it is not that simple. Providing an employee with safety information does not necessarily result in safe performance. Behavior-based safety programs attempt to overcome this issue by focusing on the positive reinforcement of safe behaviors. Behaviorist theory rests on the belief that if people perform safely through actions, they will think safely and, ultimately, create a safer culture. To a great degree, this is true. Unfortunately, one criticism of the approach is that it removes the cognitive aspect of behavior. From a training standpoint, while transfer strategies certainly help move training content to the workplace, the focus is still on teaching.

As a result of this approach, what often goes unrealized is that just because teaching occurs does not necessarily mean that learning occurs. Some even go a step further to believe that the assumed learning will result in behavior change (O'Driscoll 86). It is not that people fail to learn during training, but perhaps classroom learning is competing with other "learning." Or, as some educators believe, classroom learning may be incomplete "if it is not textured and provided within the complexities and relationships that are very much a part of the real situation" (Pratt 87). If this is the case, then one must understand what other learning activities are occurring and how they compete with well-structured SH&E training. Perhaps these other activities offer a more meaningful experience than classroom training and, as a result, become a richer source of learning.

Situated Learning:
The Apprenticeship Perspective

As noted, the transmission approach focuses on the teaching aspect of the educational process. The necessary shift in focus from teaching to learning may be a struggle for some. Many trainers try to incorporate adult learning principles into teaching by making the content relevant and meaningful and, consequently, seek innovative methods of delivery. Employees might be better served if, instead of training with learning principles added, the focus were on learning with teaching principles added.

One perspective—the apprenticeship model (typically found outside the education system)—emphasizes learning rather than teaching. Apprenticeship often comes to mind when envisioning occupations such as crafts and trades that incorporate procedural skills. However, intellectual apprenticeship is used for more complex disciplines and practices such as medicine and police work (Pratt 83). Although the apprenticeship perspective has reemerged in some disciplines, it is not high on the list for most trainers—SH&E or otherwise.

However, the basis for this approach demands closer examination. The foundation on which apprenticeship is built includes a learning theory often referred to as situated or contextual learning. Situated learning is one of several social learning theories which implies that people learn through observation and interaction with others in a social setting (Merriam and Caffarella 134).

Schemas

To understand situated learning, one must understand some conceptual terms. The term *schema* is defined as a mental codification of experience that includes a particular organized way of perceiving cognitively and responding to a complex situation or set of stimuli (*Merriam-Webster*). As people interact with the world around them, they develop concepts or schemas about the way they interpret or understand the world. When faced with a new situation, scenario or piece of equipment, they project their own collection of schemas on the new situation, framing it around what they already know. People start with simplified schemas that become more complex as they continue to learn. These schemas become building blocks for understanding the world.

Consider a child's early schema of an automobile. It may begin with a simple concept consisting of a box-like structure with windows and wheels. As the child grows and begins spending more time in cars with his/her parents, the simple schema expands to include the driver and passengers. The child recognizes that the driver has a special function and s/he may begin to observe and inquire about those functions. The schema continues to expand as the youngster begins to drive. S/he learns about the rules and laws that must be obeyed, as well as about about the car's instrumentation and controls. If this youngster learns how to drive a manual transmission vehicle, the schema expands even further. Professional vehicle drivers expand their schemas beyond those of most people.

As this illustrates, original, simple schemas are expanded, revised and linked to form more complex schemas of the world. Through experience, the process of revising, elaborating and integrating these schemas creates a complex web of knowledge and beliefs that guides thinking in a particular community of practice. From this, it becomes obvious that people with more experience have a more complex set of schemas than those with less experience.

The apprenticeship model relies on the use of developing schemas and recognizes that learning is both a product and a process. The product is a change in understanding or schema, and the process is the testing, building, revising and integrating of the schemas within a particular context of application (Pratt 84-87).
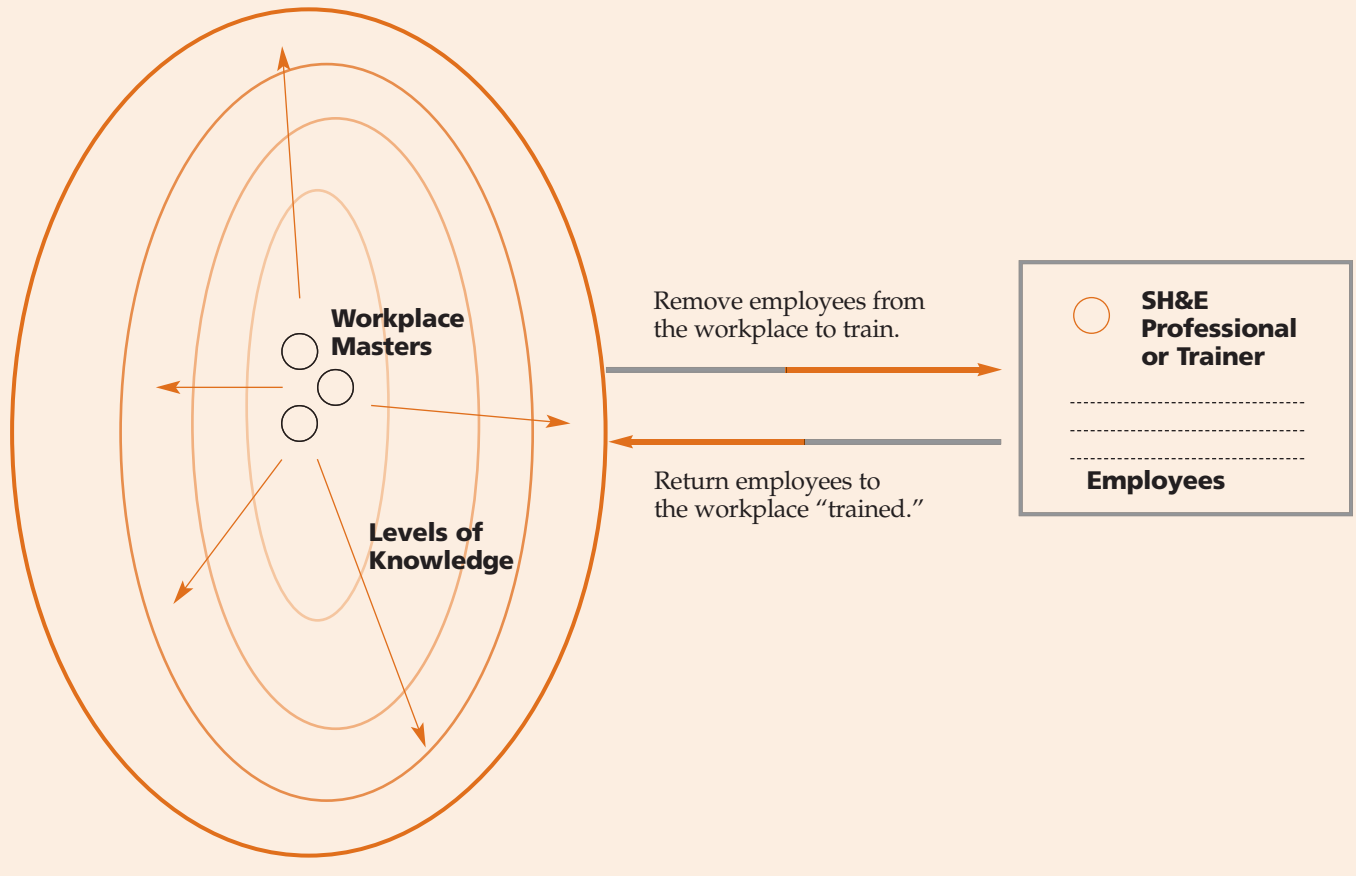
In other words, schemas developed within a setting are dependent on the context in which they are learned. A child's schema about automobiles is not developed solely (or perhaps ever) within a structured classroom setting. It is formed primarily within the social context of exposures to, with, in and around automobiles, and the driving habits and experiences of people in those contexts. From this perspective, the development of schemas becomes synonymous with learning. The new schema or learning is given meaning and significance by the context in which it is learned. As Wenger states, "meaning exists neither in us, nor in the world, but in the dynamic relation of living in the world" (54).

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Figure 1

Teaching Perspective: Classroom or Training Center

In the traditional transmission training model, employees are removed from the context of the workplace and are provided with information, knowledge and skills in a classroom or similar setting. Ideally, this information is then transferred back to the workplace. Learning that occurs within the context of the workplace (situated) can either run counter to or correspond with the learning that occurred in the classroom.

Workplace
Masters

Remove employees from
the workplace to train.

SH&E
Professional
or Trainer

Return employees to
the workplace "trained."

Levels of
Knowledge

Employees

To appreciate learning from this perspective, one must agree that reality and knowledge are socially constructed. People make meaning of situations they encounter by filtering new impressions through prior frames of reference (schemas) that are influenced by society's or the community's collective understanding and norms (Marsick, et al 10). If one examines how people learn within this perspective, the door opens to a better understanding of how people learn much of what they practice in everyday settings—perhaps even safety.

Early work by anthropologist Jean Lave explored the application of mathematics and how people apply it in a real-life setting (situated) such as in a grocery store. She discovered that people who could not solve math problems in a classroom were able to solve multifaceted problems while grocery shopping, as they determined best purchase prices or calculated quantities for a recipe (Lave). Lave and Wenger examined transfer issues, then developed the theory of situated learning. Legitimate peripheral participation is used to describe the engagement

in social activity that has learning as the central element. People choose to participate in what they call "communities of practice" based on their personal life trajectories (Billett; Lave and Wenger).

Community of Practice

Another term that must be understood is *community of practice*. This is any social group whose members share a mutual engagement, negotiate a joint enterprise and have developed a shared repertoire. It can consist of almost any social group—a sports team, a church group, a professional organization, a work department or a family. Consider again the example of the child and the car. Much of a child's learning and early schema development is formed within the family community of practice. Experience with the driving practices of parents and siblings creates the foundation for the child's learning experience.

A department within a company is a work example. The function of the department likely existed before some members entered it and will continue to exist after some members leave. In other words, the

department's shared repertoire—or a shared sense of what it is they do—does not necessarily reside solely in people, books or procedures, even though those items may exist. Although outside influences can affect the department's meaning, its real meaning is negotiated by its members through mutual engagement or participation. These individuals negotiate its meaning, function or joint enterprise, which becomes the basis for learning. Participants are not necessarily defined by physical boundaries, although they may be; some participants may reside in other buildings, or even other cities and states. Collectively, these people determine the work that they do or their shared enterprise. They also share a repertoire with regard to language, forms, stories, symbols, jargon, actions and concepts—all of which become learned by the members through participation within the department community of practice.

The Level of Participation

The concept of *legitimate peripheral participation* describes the movement and consequent learning within a community of practice. Imagine a local chapter of ASSE as a community of practice. The chapter's history or meaning exists despite people continuously joining or leaving the chapter. While national ASSE provides structure and guidance in terms of chapter guidelines, rules and model bylaws, the local chapter creates its own sense of meaning by establishing meeting times, locations, rituals and procedures. These items of meaning are actively learned by the members and shared with other members. New members must learn about these items, including acceptable (and unacceptable) activities and behaviors.

This learning occurs through participation, which begins from the "edge" or periphery as the new member interacts with other more seasoned members and perhaps shares perceptions with other new members. As the new member learns about the chapter, s/he may choose to become more involved (e.g., serve on committees). As a result, the person moves from a peripheral level of participation to a more central level, and may eventually become a source of learning for other members. Alternatively, s/he may choose to stay on the periphery and attend only an occasional meeting. These examples of communities of practice clearly illustrate that people participate and learn in numerous communities at any one time (Wenger).

The level of one's participation in a community of practice is based on many factors, including past and present participation in other communities, future aspirations and goals, and where a person is in his/her personal life trajectory. For example, a new employee may choose to participate much differently than an employee who expects to retire in two months; yet, both reside within the same community of practice. A young, single employee striving for rapid promotion will likely seek a different level of participation than a middle-aged parent of three striving to increase time spent with his/her family.

Participation in overlapping communities also affects one's level of participation. Someone working part-time while attending school (community of practice) full time in order to change careers will participate differently within the workplace community than someone focused on personal advancement in a current career, or the parent focused on managing a children's soccer team (community) or parent teacher association (community).

These examples constitute legitimate participation based on that person's current life trajectory, past and future. Lave and Wenger termed this level of activity within a community "legitimate peripheral participation," which is how learning occurs (Lave and Wenger). People choose their level of participation based on many factors, but they develop meaning when their internal world and past history schemas interact with other members of the community of practice in the present. Throughout their lives, people move in and out of various communities of practice for various reasons, both voluntary and involuntary. They may also leave a community of practice when they no longer find themselves in tune with its purpose or social rules (Marsick, et al 2). Living becomes the matter of making meaning of the present via mutual engagement with others. Learning then is the making of that meaning. Essentially, learning is an activity that occurs constantly through social interactions. It occurs whether teachers want it to or not. Trainers do not direct it or control it by their teaching, and learning happens despite them (Lave). In other words, learning is not necessarily a result of teaching, but instead is a result of living and actively participating socially in a community of practice.

What is important to understand is that situated learning "is not itself an educational form, much less a pedagogical strategy or a teaching technique. It is an analytical viewpoint on learning, a way of understanding learning" (Lave 40). This puts the learner, not the teacher, at the center of the educational experience. In this light, learning becomes an everyday activity that occurs regularly outside the classroom. According to Lave, when the principles of formal education were being formed, professionals shunned the idea of everyday real-life learning because it was not scientific and could not be analyzed through experimentation (Lave).

Situated Learning & SH&E Training

Where, then, does situated learning fit into workplace SH&E training and education? According to Baldwin and Ford, and Hoffman, only 10 to 15 percent of the content from training conducted in the workplace is retained after one year (Broad and Newstrom 7). Yet, most people probably consider themselves to be safe. Where, then, do they get the other 90 percent of information that makes up their safety knowledge base or schemas about safety? Perhaps employees are not just learning the 10 percent of information taught in SH&E training; in addition, perhaps, they gain their other safety knowledge through situated learning within the

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workplace communities of practice. "Even mis-educative experiences may be regarded as learning experiences . . . all learning begins with experience" (Merriam and Caffarella 256).

Within traditional SH&E training methods, learning is viewed as a change in behavior that can be a measured response to a stimulus in the environment. The role of the teacher is to arrange reinforcements in the learning environment so that the desired behavior occurs. This is demonstrated in training through measurable objectives (Merriam and Caffarella 137). Perhaps learning is more than just a change in behavior, although that may be the only observable and measurable phenomena. Is it possible that those people whom employees admire and after whom they model their behavior are teaching which SH&E concepts are important and which are not?

Many SH&E professionals would agree that this is the case and often mention it in discussions on the importance of leading by example and peer pressure; however, little research has explored this concept as a legitimate form of learning. Instructors can "teach" through transmission in a classroom that wearing safety glasses in a certain area is important; students can demonstrate that they have "learned" this material by passing a quiz.

But what have they really learned? They have learned the information to pass the quiz, which becomes the critical shared meaning in the classroom community of practice. But once the employee leaves the classroom, however, s/he may "learn" within the workplace (community) that wearing safety glasses is not important. Even more subtle, but reflective in the same observable behavior, the employee does not learn the importance of wearing safety glasses within the workplace. In other words, the value of protective eyewear is covered as part of the training curriculum, but it is not included in the workplace curriculum—it is not part of the shared meaning created within that community of practice. Essentially, what was learned in the classroom becomes irrelevant. As Wenger states, "after they complete their classes and start working 'on the floor,' then integration into the community of practice (learning) really begins" (99).

For most employees, their legitimate participation within the workplace community may be more significant in their personal life trajectory than their participation in the training classroom (community). SH&E trainers can provide statistics on eye injuries and demonstrate various types of safety glasses, but what employees learn when they get "on the floor" may be different. They may learn that glasses are not needed because within that community of practice being safe does not necessitate wearing safety glasses. Other employees may decide to wear safety glasses despite what they are learning—or not learning—within the workplace, perhaps through experience within another community of practice (e.g., a different workplace, personal experience with eye injury).

Modeling, Coaching, Scaffolding & Fading

The concept of situated learning has begun to be recognized as significant in other disciplines, although little research has been done in SH&E regarding such learning. For example, Stephen Billett (2001) is working to incorporate situated learning concepts in different workplaces through the development of workplace curricula. These curricula use apprenticeship concepts such as modeling, coaching, scaffolding and fading to develop workplace skills.

The concept of modeling gives the novice an opportunity to observe an expert performing a task. The idea of observation is critical because it allows the novice to get "the big picture" and begin to form a schema into which future learning will be incorporated. Modeling also provides a point of reference within the context in which the task will be performed. If a new employee enters a work area where safety is being practiced by the "masters," this will serve as a model for learning.

Scaffolding occurs when novices try to perform new tasks and are supported by the expert or master. The expert provides the support in a manner that is sensitive to the individual needs of the novice and is also encouraging (coaching). Coaching further supports the activity. Generally, the novice begins with lower accountability tasks identified by the master. Fading occurs when the expert gives the novice an opportunity to practice the skill with little support. During fading, the master may be nearby to help as needed.

While many people may be unfamiliar with these terms, most people understand the concepts they represent. Consider how a person learns to ride a bicycle, drive a car or operate a lawnmower safely. Are these skills taught around the kitchen table or in the living room with the person then sent off to perform them? Probably not. Instead, an apprenticeship approach is likely used.

As the first step, the master (teacher) demonstrates for the novice (student) how the entire process is done. In the lawnmower example, the novice may watch the master take the mower out, fill it with gasoline, don proper PPE, start the mower and mow the lawn (modeling). This may actually occur prior to the learning experience, but clearly the schema about lawnmowing has begun to form in the novice's mind. When it actually is time for the novice to operate the mower, the master may demonstrate the steps (modeling), providing verbal explanation and pointers as the steps are performed (coaching). Perhaps the master then allows the novice to try the process while the master offers guidance and support (scaffolding). Finally, the master allows the novice to perform the entire task with little assistance, as the master stands by and watches, ready to offer help as needed (fading).

Apprenticeship Example

The apprenticeship approach is demonstrated in "Zen and the Art of Rockbolting," part of NIOSH's mine safety program. In explaining the rationale for using this approach, video producer Elaine Cullen notes that miners are not going to sit in a classroom and listen to a safety lecture. As part of her project to examine the development and evaluation of effective mine safety training, NIOSH wanted to gather data

on the concept of mentoring/apprenticeship. The agency wanted to "capture" a master at work and present it in video format. Cullen selected a highly respected miner as the focus.

As the video progresses, apprenticeship concepts emerge. Throughout much of the video, the master and apprentice miner work together. Information provided to the apprentice is appropriate from a quantity and timing standpoint. In other words, it is "just enough information" for the particular task and is "just in time" for that particular task. This is significantly different than the "too much" and "just in case" information that is often provided in a classroom.

The information is also provided in a contextual manner to the work that is being performed at that moment. In this manner, the information is real rather than abstract. The master miner also has the contextual knowledge from years of experience performing this job. The SH&E professional and trainer, while being content experts, may lack the actual work experience that gives the learning opportunity a high degree of credibility (NIOSH). Maximizing situated learning through apprenticeship techniques might be applied with other workplace safety programs as well. This would require that SH&E professionals change roles from teachers to coaches as safety moves out of the classroom and into the workplace.

Pilot Program:
Biotech Respirator Use

In a pilot program being conducted at a biotech company, a large number of employees are required to wear air-purifying respirators for cleaning and chemical transfer processes. Prior to the program, respiratory training and fit-testing were conducted monthly. Employees were trained using a video, lecture with slides, demonstration and group discussion. Learning was evaluated via a written quiz. Employees also had to properly demonstrate donning, doffing, and positive and negative user seal tests, as well as other skills using a respirator. By comparison, this was a comprehensive training program. However, a questionnaire administered before implementing the pilot program indicated that employees were confused about several issues, including proper cartridge selection, respirator storage and cleaning, and performance of seal tests.

For the pilot program, 12 employees were selected from departments in which respirators were used. This group received in-depth training on respirator use; the session lasted a total of about 10 hours initially, with monthly meetings planned for continued learning and sharing. The initial learning experience included anatomy and physiology, respi-
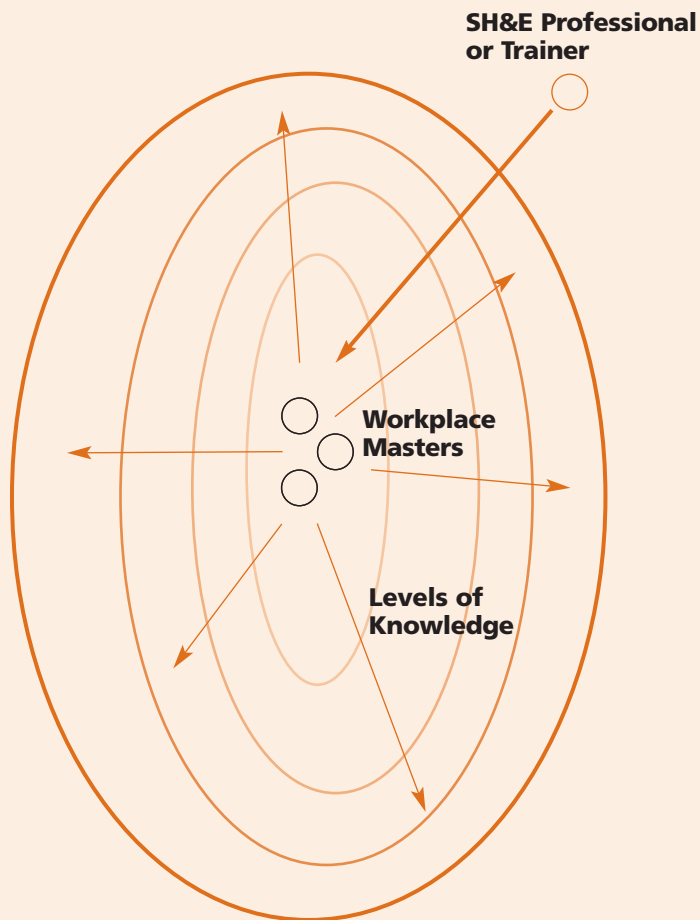
Figure 2
Learning Perspective:
Organization Community of Practice

In a situated or contextual learning model, the teachers in the workplace (masters) are provided with the safety information, knowledge and skills. This is a negotiated process in conjunction with the SH&E professional. The SH&E professional becomes a team member with the other workplace masters. The information, knowledge and skills are then disseminated to the employees within the context of the workplace during the normal work routines. Safety becomes part of the culture and not a separate curriculum.

SH&E Professional or Trainer

Workplace Masters

Levels of Knowledge

rator and cartridge selection, and other key topics. The training was provided by SH&E professionals modeling the same apprenticeship methods that were to be used by the participants. Interestingly, it was a challenge for these trainers to remain focused on the apprenticeship model rather than revert to merely transmitting the information to the group.

Sessions were conducted in such a way that the SH&E professional was a member of the team (community of practice). This provided the content expertise in respirator use, while other team members provided the workplace content expertise. Issues discussed included concerns identified on the preprogram survey. Solutions were negotiated with

members of the respiratory team—that is, the group collectively decided how the issues would be addressed. This team continues to meet regularly to address issues (mutual engagement), update its understanding (shared repertoire) and share learning experiences. Team members have begun to reach a high level of mastery and comfort regarding respirator use and modeling. Once the level of comfort was achieved, decided mutually with the SH&E professional, they began their work as masters, using an apprenticeship approach to teach other employees the proper context for the specific use of respirators.

A workplace curriculum was developed that allows new employees (novices) to first observe respirator use (modeling); following medical clearance and fit testing, they then begin to learn basic skills. Accompanied by a master, the novice begins with tasks that have low levels of accountability. Basic learning includes proper storage, cleaning, selection and seal tests. At the basic level, users demonstrate the skills required in the classroom session. Novices must work with masters until they mutually reach a level of comfort using a respirator. Scaffolding, coaching and fading are also incorporated into the process.

As the user's skills increase, s/he moves from peripheral participation to a more central participation, moving through designated levels of mastery that include novice, basic, skilled and master. These levels were decided by the team of masters and again demonstrate a shared repertoire and negotiated meaning. Advancement through each level requires an increase in skills. These skills include guided learning (being "masters") for employees at lower levels.

For example, a basic-level employee would be able to properly wear a respirator, and may also begin modeling and coaching a novice on respirator storage. At the master level, employees may help to select the proper respirator for a new chemical. This process would include involvement with the SH&E professional. While it is still too early to evaluate the results of this program, early indications suggest that the process will have a positive impact on correct respirator use and maintenance. Concerns identified on the preprogram survey have begun to resolve. For example, respirators are being properly stored, cleaned and used throughout the facility.

A similar program that includes leadership training typically provided by human resources is being considered at another location. This program will provide a similar SH&E curriculum, but will also incorporate leadership principles in development of master skills in coaching and mentoring. The author and a colleague are developing workplace curricula for several SH&E-related topics that will allow the learning experience to become situated within the context of the workplace. Developing and sharing the outcomes of using these curricula will hopefully allow other SH&E professionals to implement similar programs.

Conclusion

Other training and development professionals have begun to take notice of the importance of contextual learning within a community of practice (learning community). Using the term learning organization, companies seek ways to encourage and maximize learning in action. According to Peter Senge, learning that matters is inseparable from the work that the employee performs. He believes that the trainer is not nearly as knowledgeable as the supervisors or managers in understanding the complexity of the work. In a learning organization, it is much better to replace the classroom metaphor with a practice field or rehearsal hall. "Learning is a much more complex phenomenon than can ever be limited to a classroom. It is inextricably connected to how we live our lives, and to the excitement, challenge, motivation and support woven through our daily experience" (Senge 46). The same principles apply to safety if one acknowledges that learning safety is part of the work performed, not something that is taught outside the context of the workplace setting.

By focusing more attention on learning rather than on teaching, and by looking at learning as a contextual or situated experience, SH&E professionals can begin to exert their energies in areas that may have a greater impact on workplace safety. While greater understanding is needed in this area, encouraging such learning can greatly impact the effectiveness of current SH&E training. This approach can help establish a culture that includes the SH&E principles and learning opportunities necessary for higher levels of employee involvement. By nurturing situated learning in the workplace, SH&E professionals can help establish a system of employee involvement that takes the definition beyond a nebulous concept. ■

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