

Principles of Adult Learning

Application to safety training

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THE U.S. WILL FACE A SHORTAGE of 10 million skilled workers by 2010, according to the Bureau of Labor Statistics. Each year in the U.S., millions of dollars are spent to train adults—ranging from \$658 per employee in healthcare to \$1,059 per employee in the service sector (Speizer, 2006). Companies are searching for a competitive advantage through workers who are better trained and each development dollar expended needs to directly correlate to the bottom line.

At the intersection of training and development lies andragogy, an often-overlooked adult learning theory. Andragogy—the study of adult learners—is distinct and plays an important role in effectively training adults. This article describes the elements of andragogy and the importance of incorporating these learning principles into safety training. In addition to examining current adult education theories, the article defines andragogy and discusses elements of adult learning. It also reviews a limited study regarding the inclusion of adult learning principles in safety training.

The Process of Learning

Learning is often defined as a permanent change in behavior or as knowledge acquired by study. Creating a learning culture is imperative in today's economy. In the workplace, such a culture begins with corporate training and education at colleges, technical schools and universities. Many government-sponsored programs require employee training to promote safety, growth and development. Other agencies and corporations use training to enhance productivity, train new employees or promote employees.

Adult learning must begin with a basic understanding of ways that adults learn. Often, trainers know the content to be presented, yet they may be unaware of the most effective methods to deliver the information. In the SH&E field, the difference between effective and ineffective training may be death, injury, pain, suffering and lost profits (Robotham, 2001).

Can training be more effective if adult learning strategies are incorporated? A limited study conducted at Carnegie Mellon University measured behavior changes in laboratories following safety training. The study compared OSHA violations as measured through laboratory inspections following two groups of employees. The goal was to look beyond satisfaction ratings for the training and to focus on measuring the impact of the training on observable behaviors in the workplace. Before discussing the study and its outcomes, let's discuss adult learning theories—andragogy in particular.

Adult Educational Theories

How do adults learn? Table 1 shows the five fundamental adult learning theories that are the focus of most literature: sensory stimulation theory, cognitive theory, reinforcement theory, facilitation and andragogy (Munoz & Munoz, 1999).

Andragogy is the focus of this article. A Chinese proverb advises that "the beginning of wisdom is to call things by their right name." Andragogy and pedagogy refer to the study of teaching, with *andra* meaning *man*, *adult* and *peda* meaning *child*. Thus:

[A]ndragogic learning designs involve features which recognize the essential maturity of the learner; they are problem-centered rather than content-centered; they encourage the learner to introduce past experiences into the processes in order to reexamine that experience in the light of new data; the climate of the learning process must be collaborative as opposed to authority-oriented; planning and evaluation are mutual activities between learner and instructor; evaluation leads to reappraisal of needs and interest and activities are experiential, not "transmittal and absorption" as in standard pedagogy (Laird, 1985, pp. 125-126).

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Table 1

Adult Educational Theories

Adult educational theory	Overview of theory	Application for training
Sensory stimulation theory	Senses must be used in the learning process for change to occur.	Involve all the senses; use media and a variety of techniques.
Cognitive theory	The purpose of learning is to teach the brain to engage in critical thinking and problem solving.	Provide hands-on problem-solving activities.
Reinforcement theory	Based on behavioral psychology; stimulus and response.	Provide opportunities to observe the participant's response, then provide reinforcement.
Facilitation	Emphasizes the learner's involvement in the learning process and the relationship between the instructor and the learner.	Provide a comfortable atmosphere and opportunities for the learner to interact with the instructor/facilitator.
Andragogy	Focuses on the importance of relevance and other adult learning principles.	Explain the training objectives up front and immediately engage trainees.

What Is Andragogy?

Although adult learning theory was pioneered by Malcolm Knowles, the field of study is relatively new. The term andragogy was first used in 1833 by a teacher in Germany and was reintroduced by a German social scientist in the 1920s. The term was further adopted by adult educators in Europe in 1957 before coming to the U.S. (Thoms, 2001). Although pedagogy originated with early monks who recorded common characteristics among children who were learning basic facts, it was not until the mid-20th century that instructors realized that their assumptions about how children learn did not apply to adults (Knowles, 1984a). Therefore, the more formal discipline of andragogy research continues to expand.

Learning is required throughout one's life in order to adapt to life's circumstances and the environment. Most research confirms that the ability to learn increases throughout a person's life from age 20 to 70, although the needs of adult learners and the context in which learning occurs differ from childhood.

Learning can be formal (e.g., in-classroom education) or informal, and is usually motivated by an individual's transitions and experiences. Adults may seek more formal education to advance in their careers or develop new skills, or as continuous learners to develop personally and professionally. The learning demands that adults face will depend on their choices, opportunities and resources, and will be affected by factors such as social, cultural and historical contexts, as well as gender, class and ethnicity (Lemme, 2002).

What is an adult learner? Knowles (1984a) identified adults by two criteria: 1) an individual who performs roles associated by today's culture with adults (e.g., worker, spouse, parent, soldier, responsible citizen); and 2) an individual who perceives himself/herself to be responsible for his/her own life.

Knowles (1984a, 1984b) also identified a series of characteristics of adult learners:

- **Autonomous and self-directed.** Trainers should

involve participants in the learning process and serve as facilitators, not teachers.

- **Accumulation of life experiences.** Adult experiences should be incorporated into the learning to provide a base of connectivity and relevance.

- **Goal-oriented.** Structure training with defined elements that are consistent with the learners' goals.

- **Relevancy-oriented/immediacy.** Set objectives immediately so that learners can relate to the concepts and understand the reasoning behind the objectives, then can apply them in their own lives.

- **Practical.** Focus on the "what" and the "why" so adults will apply the lessons that are most useful in their environment.

- **Respect.** Trainers should encourage participants to add value by sharing their experiences and allow for freedom of expression (Lieb, 1991).

A basic assumption of adult learning is that it is best achieved in dialogue. Principles of adult learning include the belief that adults have sufficient life experiences to be in dialogue with the trainer on any subject and, in fact, they will learn new knowledge, skills and attitudes best in relation to their experiences (Vella, 2002).

Principles of Andragogy & Applications to Training

Some principles are critical to beginning, maintaining, nurturing and retaining dialogue with adults. Needs assessment is the first principle of andragogy or adult learning and it involves the participants' contribution to the content of the material to be learned. Instructors and learners should shape course content based on the relevance and applicability to adults (Vella, 2002).

Safety is the second principle. It is linked to respect for learners as decision makers and also the trainer's ability to create an inviting environment for adults. A trust in the competence of the design and the instructor, a relevancy of the learning objectives,

an ability to express thoughts and logic to the sequence of activities all contribute to a safe learning environment (Vella, 2002).

Sound relationships are the third principle. They are essential—starting at the initial meeting between the trainer and the student—to establishing a sense of inquiry and curiosity. Learning cognitively, affectively and with psychomotor aspects are principles that are often neglected. Using these three aspects—learning with the mind, emotions and actions respectively—can reduce the anxiety associated with a new event in adult learning.

Praxis is a Greek word that means *action with reflection*. Most educators agree that the application of this fourth principle is valuable since adults learn by doing and praxis is a form of doing with built-in reflection. Learning tasks is then not a matter of practice but praxis. Inductive forms of learning invite reflection or action on a particular circumstance using new content. If the learning is deductive, participants consider new content and ways to apply the material in new scenarios. In both, the adults practice a new skill and are encouraged to analyze the quality of their practice—transitioning practice to praxis (Vella, 2002).

Participants should receive material in bite-size chunks. This prevents them from becoming overwhelmed and allows an opportunity for mastery. Adult learners also prefer the “whole-part-whole” learning strategy that demonstrates the new skill or use of knowledge, describes the details, then reinforces the concepts using other examples (Thoms, 2001).

The final three principles are teamwork, engagement and accountability. Teams can provide a quality of safety and real-world experience. Teams simulate a participatory universe in which people live, and learning is enhanced by peers who can assist and mentor with clarity, tenderness and skill. A healthy environment of competition is fostered. The word competition is derived from *com* meaning *with* and *petition* meaning *asking*—as in an environment in which participants are asking and learning together. Instructors can use activities that foster constructive competition by structuring teams so they work together collaboratively in the learning process and encourage pride in their achievement as a team. Generally, adults work enthusiastically in teams when the learning tasks are related to themes and adequate time is provided for the task.

The concept of engagement refers to learners being actively involved with issues of their organizations and their communities versus passive units of production as described by scientific management scholar Frederick Taylor. Trainers can engage teams in learning by involving them in strategic planning sessions so that it becomes difficult for the students to extricate themselves from the excitement of learning.

Finally, accountability encompasses all of the principles, as the design of learning events must be accountable to the learners in the form of the learning outcomes being met. Possible outcomes include: what was proposed to be trained is taught; what was

meant to be learned is learned; the skills intended to be gained are visible; and the knowledge to be conveyed is manifest in the adults’ language and reasoning (Vella, 2002, pp. 24-27).

Andragogy & Pedagogy

Although most research has been devoted to childhood learning and development, many attributes of adult and child learners are similar. Like children, adult learners need to play, take initiative, make choices, act and interact. Learning should be fun and exploratory, and people in that stage of learning do not need challenges, they need shared enthusiasm (Jones, 1986). When comparing an adult and child in a learning situation:

- Children are dependent while adults see themselves as self-directing.

- Adults expect to be able to answer part of their questions from their own experience and children expect their questions to be answered by outside sources.

- Children expect to be told what they need to do, while adults may have a very different viewpoint on that issue based on firsthand experience.

- Adults frequently want input in their learning.

Several other differences are important to note and should be applied in an adult learning environment as well. Three such differences are:

- life experience as a barrier;

- life experience as a positive trait;

- understanding the relevance to their lives (Alexander, 1999).

Adults arrive at training with baggage when compared to children. They have many more life experiences, time demands and psychological barriers (such as past negative experiences). The instructor should attract and maintain attention and evaluate the experiences that may hamper the learning process. Disengagement will occur when adults have had negative educational experiences they need to overcome before they can learn new skills. Adults also may be plagued by more incorrect information and knowledge than children, which impedes the learning process.

In contrast, the life experience that adults bring to learning may provide the foundation for their new learning. Adults benefit from reflecting on, sharing and communicating their insights with others (Alexander, 1999). This practical knowledge can be an asset during the moments of reflection if the instructor can encourage dialogue and curb comments such as, “This is how we did it.” Otherwise, participants may not want to change procedures or may not be open to new ideas (Thoms, 2001).

Adults also must see the relevance of the material to their immediate needs since time limitations and commitments apart from work may make it difficult to make learning a priority (Alexander, 1999). They want a choice in the content and have a strong need for immediate application.

The question posed by the study described here was, “Will incorporating these adult-learning strate-

Table 2

t Test Results Comparing Old & New Training

Training	M	SD	N	95% confidence interval of the difference	
				Lower	Upper
New	3.18	1.20	60		
Old	4.17	1.53	60		
				.49	1.48

gies affect the training results to a degree that demonstrates the need for application in future training?"

Scope of the Project

The project was conducted at Carnegie Mellon University to determine whether this no-cost application could affect behavior within the school's laboratories. The study targeted new employees with the rationalization that training the new, then indirectly the current, employees would affect the climate of safety at the university. The study was developed to look specifically at OSHA requirements and regulations with the thought that following these requirements would translate to reducing the possibility of incidents and injuries.

The Environmental Safety and Health Department at the university, as part of a program evaluation (per 3.4.1 of ANSI Z490.1-2001), identified a need to assess the effectiveness of laboratory safety training. Department members began to evaluate slides used within the training as well as to monitor laboratory safety inspection data. In doing so, they became concerned about the number of regulatory violations noted during the inspections. While the number of reported incidents had not increased, the department wanted that trend to continue by improving the climate of safety within the university.

Therefore, the department looked to both internal and external resources with a goal of designing a new safety training program that would include observation of safety behaviors in the labs after employees had attended training. This project was conducted with the assumption that decreasing the number of regulatory violations would be a preventive measure which would help to retain a safe environment. Department leaders wanted to observe behavior change rather than simply rely on participants' satisfaction with the training satisfaction, which is usually measured with post-training surveys. This project was designed to assess observable behavior following the training.

Seventy-three participants were selected from 20 different departments and divided into two groups—those who attended the "old" training and those who attended the "new" training. Since trainees were scheduled based on employment date, it is assumed that the groups would be relatively homogenous. The training sessions covered the same OSHA standards applicable to laboratories, including safe handling procedures, housekeeping procedures and PPE requirements. The original training met criteria outlined in ANSI Z490.1-2001, but it did not actively employ recommended strategies for

adult learning theory. Based on casual observations of staff members, the behaviors discussed in training were not being transferred to the workplace. Therefore, the new program was designed to include activities that would involve the learners and demonstrate the relevancy of the training to their individual situations.

The new training incorporated the following elements of adult learning theory:

- placing material into bite-sized chunks and using the whole-part-whole concept;
- simulating the worker's actual environment, providing scenarios and problems;
- designing training to meet participants' needs.

Relevance for employees should be enhanced by reviewing the training objectives up front, then organizing the training by major categories. While there was no specific test for relevance, those involved expected to see a decrease in violations related to the safety behaviors that were discussed in training.

Staff members randomly observed training participants after they completed the training to verify that safety precautions were being followed. Since the observers were monitoring for behaviors during their inspections, the only training they required was how to document violations. Laboratory employees would not notice any difference in the inspections so it was determined that behaviors observed would not occur simply because employees were reacting to the inspectors.

The laboratory auditor technician recorded safety and regulatory violations in the following behaviors:

- Wearing proper protective gear. Wearing eye protection, lab coat, gloves and appropriate clothing (no open-toed shoes, long pants);
- Using proper housekeeping practices. Work area neat and orderly, no evidence of eating or drinking, and no one working alone.
- Containers (primary and secondary) labeled correctly.
- Hazardous waste container properly labeled, closed and in secondary containment.

The auditor completed the record sheet as the laboratories were inspected on a random basis. The observation occurred within 1 week of the training session and any violations observed were noted. Data were then entered into a database and SPSS was used to analyze the data through the use of t tests (Table 2).

Since the interval of 0.49 to 1.48 does not include zero, the data support the hypothesis that the number of safety violations would decrease between the old and new training groups, and the null hypothesis was subsequently rejected. The hypothesis was one-way only—that there would be a decrease in the number of violations.

Comparing the Training Programs

The original training program began by discussing the regulations involved, whereas the new program began by showing the training objectives

Table 3

Comparison of Old & New Training

Old training	New training
No objectives specified	Objectives given in the beginning
Limited emphasis on discussion	Increased emphasis on discussion
Use of clip art	Use of actual laboratory photos
35 participants (randomly selected 20 to represent different departments)	38 participants (randomly selected 20 to represent different departments)
Observed beginning 1 week following training	Observed beginning 1 week following training
October - December	January - March

so that employees knew what to expect and ways in which the training would impact them personally.

The original program was primarily lecture-based with a handbook and question-and-answer session at the end. Participants also were given a quiz at the end and the answers were discussed before a grade was recorded—a procedure that was explained before the training began. The training immediately delved into the rules and regulations, guiding the training instead of focusing the employees on workplace safety. The presenter detailed the rules and regulations requiring employee attendance, but there was no other discussion regarding training goals or rationale.

The new program used photos from laboratories on campus rather than the clip art found in the original program. The new program also included sections arranged to provide whole-part-whole information so participants would get the “big picture,” then discuss the specifics. At the start of the session, participants were given the opportunity to describe what they hoped to gain from the training. This discussion helped to focus employees and provided relevant reasons—other than simply fulfilling a requirement—for attending the training.

Limitations

Several limitations of this study must be noted:

1) The sample size was small—only 20 in each group. Forty of the 73 total participants were used in order to have evenly matched departmental groups. The sample size was selected after discussing practicality and time constraints with the staff.

2) No baseline data were available for the selected participants to see whether the training alone was responsible for the decrease in infractions.

3) Only the beginning portion of the newly designed training was implemented. An online portion and a hands-on test have been designed for the future. Therefore, further observations are needed to determine whether there would be a greater effect.

4) The presenter changed between the old and new training sessions, thus presenter personality may have had an effect. Both presenters were experts in the field and both knew the program content extremely well. In addition, the original presenter worked with the panel to develop the new program.

Implications for Trainers

Training professionals should strive to use as many adult learning principles as possible. The principles that this study found to be most critical are:

•**Relevance.** The material presented should be relevant to the adult participants. This is best accomplished when the participants realize and recognize this relevance themselves.

•**Similarity.** To facilitate the transfer of skills learned, the information presented should closely resemble the employees’ workplace conditions. The trainer must be able to spend time in the workplace

or provide activities in which the participants can supply the similarity through materials they bring to the training or discussions and role-play.

•**Active participation.** Employees should be able to interact with other workers and the trainer. The atmosphere should help them feel safe to risk participating. It takes adults longer to perform some activities and to feel safe to speak out and ask questions.

•**Providing objectives.** By showing the objectives in the beginning, adult learners can see the big picture and know the direction of the session. They also can judge the time and know when the training is almost over. Adults have many demands on their time and attention so it is important to define the parameters of the training in advance.

After evaluating the new program through observations of training participants, it was noted that the number of violations has decreased. However, there is still room for improvement on campus. The number of violations that continue to occur in the laboratories warrants the ongoing improvement of training practices.

After analyzing the results from the two training groups, the hypothesis was supported—the new training participants showed a significant decrease in safety violations. There was an average decrease of .99 violations between the two groups. To further support the results, the data among departments and between genders was examined. The only instance of a significant difference in means occurred between the old and new training groups. The training may have accounted for this decrease, but, ultimately, it was the employees’ behavior that was responsible for the decrease. Because no baseline data were collected for each participant before training, it was assumed that the training was responsible for the decrease.

Is the decrease of one violation realistically significant concerning laboratory worker safety? When examining the results, the violations were found to be statistically significant when comparing average violations. When OSHA or EPA inspects the laboratories, even one violation could result in fines and sanctions. Therefore, by eliminating safety violations, overall safety and laboratory quality is improved.

It also is important to note that even one safety violation could result in injury or property damage, or negate research results. So, the one-violation reduction could mean an eye saved from a chemical splash if that person wears safety glasses after attending the training. Any reduction in violations means that the laboratories are safer following the

training than before the training. Therefore, realistically, even a decrease of one is significant.

Recommendations & Conclusion

The major difference between the training sessions was the inclusion of relevance so that trainees understood the program's objectives. They were made aware of gaps in their knowledge—where they are versus where they need to be—which should be a goal in every training session. Explaining how the training will help the participants encourages engagement. This limited study also suggests that dialogue is instrumental in successful adult learning and application.

Incorporating adult learning theory and practices into workplace training is compelling when compared to incurring the cost of even one injury or fatality. A safe work environment should be the goal of every organization and the adoption of andragogic concepts can support this objective.

This project showed the contribution to be gained by incorporating adult learning principles and focusing on the value of safety and the relevance to the trainees' well-being. When adults participate in the content and understand the training, they are more likely to engage in the process and transfer the training concepts to their daily work routines. The principles of adult learning should be applied to safety training and in an effort to attain the best

working environment for all employees. "Adult learning takes place in context, where tools and the context intersect with interaction among people" (Merriam, 2001, p. 43). Andragogy is relevant in safety training because minimizing even one error could prevent permanent damage.

Each year, more than 40 million adults participate in educational activities including safety sessions. Effective training is an important competitive differentiator and those companies that focus on adult education may benefit financially. To address the impending shortage of skilled workers, engaging adults through relevant training will help mitigate these deficiencies. As the Chinese proverb says, "Fish for me and I eat today. Teach me to fish and I eat forever." ■

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ASSE on Adult Learning

ASSE offers several books that include information on meeting the needs of adult learners in today's complex work environments.

The Participation Factor:

How to Increase Involvement in Occupational Safety

What safety slogans are more appropriate? What kinds of incentive/reward programs could increase participation? And what safety performance metrics should we use to increase positive stress rather than negative stress (or distress) and, thereby, encourage empowerment and involvement? In answering these questions, E. Scott Geller debunks many of the myths behind the "common sense" approach to improving participation. (ASSE Order #4391)

Safety Supervision

This book will both broaden the supervisor's safety skill set and provide practical, results-oriented and measurable improvement in crucial supervisory activities. The author explains how proven coaching and motivational techniques, applied to supervisory safety practices, combine to produce a "safety culture" at all levels of the workforce. (ASSE Order #4363)

Managing the Generation Mix

Generational conflicts mirror critical business issues every organization faces as it transitions from the workplace of the past to that of the future. This book is designed to help readers facilitate collaboration within a multigenerational workforce. (ASSE Order #10634)

Coaching & Mentoring Skills

Topics include building trust, showing empathy, active listening, using influence tactics, goal setting, giving feedback and training. In addition, case studies, self-assessments and skill-building exercises are included. (ASSE Order #10603)