



Education Techniques for Lifelong Learning

Principles of Adult Learning¹

Jannette Collins, MD, MEd

The adult education literature supports the idea that teaching adults should be approached in a different way than teaching children and adolescents (preadults). Many aspects of effective teaching apply to all age groups. However, adults have had more life experiences and in many ways are differently motivated than children. Adults are more self-directed in their learning and have a greater need to know why they should learn something. Self-initiated learning is the most lasting and pervasive. Learning should be applicable to the learner's work or to other responsibilities valued by the learner. Thus, it is important that the instructor know the learner's needs and design learning activities that are relevant to those needs. The learner should be actively involved in learning, with the instructor acting as a facilitator. The instructor should recognize that adults have different learning styles and should tailor instruction to the characteristic ways adults prefer to learn. Understanding the principles of adult learning can help teachers become better facilitators of learning.

©RSNA, 2004

Index terms: Education • Radiology and radiologists

RadioGraphics 2004; 24:1483–1489 • Published online 10.1148/rg.245045020 • Content Code: HP

¹From the Department of Radiology, University of Wisconsin Hospital and Clinics, E3/311 Clinical Science Center, 600 Highland Ave, Madison, WI 53792-3252. Presented in the RSNA Faculty Development Workshop, September 2004. Received February 17, 2004; revision requested March 22 and received March 26; accepted March 29. The author has no financial relationships to disclose. Address correspondence to the author (e-mail: j.collins@hosp.wisc.edu).

©RSNA, 2004

Introduction

The adult education literature supports the idea that teaching adults should be approached in a different way than teaching children and adolescents (preadults). Many aspects of effective teaching apply to all age groups. However, adults have had more life experiences and in many ways are differently motivated than children. Adults are more self-directed in their learning and have a greater need to know why they should learn something. They have set habits and strong tastes. They may have prejudices, which are detrimental to the learning environment. They want a choice in what they learn. These characteristics of adult learners can be addressed in the learning environment to optimize learning. Understanding the principles of adult learning can help teachers become better facilitators of learning. The importance of these principles is recognized in educational and business settings (1). This article discusses the differences in how adults and preadults learn, the science of adult learning principles, and how these principles can be applied to radiologic education.

Adult versus Child Learners

The assumption that teachers of adults should use a style of teaching different from that used with children is based on “informed professional opinion; philosophical assumptions associated with humanistic psychology and progressive education; and a growing body of research and theory on adult learning, development, and socialization” (2,3). Malcolm Knowles, who is considered the father of adult learning theory (4–6), coined the term *andragogy* to describe the study of adult learning. He distinguished adult learning from pedagogy, the study of how children learn. Initially, it was thought that pedagogy and andragogy were two distinct processes, but current theory sees the two processes on a continuum, with pedagogy on one end and andragogy on the other. What separates these two processes on the continuum is the quantity and quality of experiences the learners have when they enter the learning experience and the amount of control that the learners have over the learning process and environment (7).

By contrasting andragogic, or learner-centered methods, with pedagogic, or teacher-centered methods, Knowles argued that adults differ from preadults in a number of important ways that affect learning. According to Knowles, the pedagogic model is inappropriate for use with adults.

However, since he first proposed the model, Knowles has gradually modified his position regarding the contrast between how preadults learn (pedagogy) and how adults learn (andragogy). According to Feuer and Geber (3,8), “what he once envisioned as unique characteristics of adult learners, he now sees as innate tendencies of all human beings, tendencies that emerge as people mature.”

Science of Adult Learning

Until recently there has been no effort to test whether teachers actually use a different style when teaching adults. In two different studies (2,9,10), researchers found that teachers believed adults to be significantly more intellectually curious, motivated to learn, willing to take responsibility for their learning, willing to work hard at learning, clear about what they want to learn, and concerned with the practical applications and implications of learning than were children and adolescents. In one of these studies (10), the following groups of teachers were found to be the most flexible and responsive in both adult and preadult classes: less-experienced teachers, female teachers, teachers who taught personal enrichment adult classes, secondary teachers, and teachers who reported high teaching differences between how they taught adults and preadults.

Although teachers perceive adults as being different, these perceptions do not automatically translate into differences in approaches to teaching (3). Perhaps the real issue is not whether learner-centered methods are universally applied by teachers of adults, but rather for what purposes and under what conditions such methods (and others) are most appropriate and effective and in fact are used by teachers (2). The educational approach should be based on the purpose of the teaching-learning situation. The andragogic or learner-centered approach is probably not appropriate in all adult education settings (8). The approach should be based on the goals of the learners, the educational content, and other factors. The concept of adult learning is relatively new, and more research is needed in this area to determine the most effective applications of adult learning principles.

Adult Learning Principles

There are a number of “principles” that have been associated with adult learning (Table 1). Some of these are unique to adult learning and some apply to preadult learning. (As stated, current theory sees the two processes on a continuum with pedagogy on one end and andragogy on the other.)

Table 1
Principles of Adult Learning and Their Application to Radiologic Education

Principle	Application
Adults have accumulated a foundation of life experiences and knowledge.	Connect life experiences and prior learning to new information.
Adults are autonomous and self-directed.	Involve participants in the learning process, serving as a facilitator and not just a supplier of facts.
Adults are goal-oriented.	Create educational programs that are organized with clearly defined elements, clearly showing how the program will help participants reach their goals.
Adults are relevancy-oriented and practical.	Help learners see a reason for learning something by making it applicable to their work or other responsibilities of value to them.
Adults (all learners) need to be respected.	Acknowledge the experiences that adult participants bring to the learning environment, allowing for opinions to be voiced freely.
Adults are motivated to learn by both intrinsic and extrinsic motivation.	Show learners how the learning will benefit them and create a comfortable and appropriately challenging learning environment.
Adults learn best when they are active participants in the learning process.	Limit lecturing and provide opportunities for sharing of experiences, questions, and exercises that require participants to practice a skill or apply knowledge.
Not all adults learn the same way.	Accommodate different learning styles by offering a variety of training methods (eg, group discussion, role-playing, lecturing, case studies, panel/guest expert, games, structured note-taking, individual coaching, demonstration, and variation in media used) and by using visual, auditory, and kinesthetic techniques.
Adults learn more effectively when given timely and appropriate feedback and reinforcement of learning.	Provide opportunity for feedback from self, peers, and instructor.
Adults learn better in an environment that is informal and personal.	Promote group interaction.

Adults bring a great deal of background experiences and prior learning to any new learning process. Acknowledging adults' understanding and experiences validates them as competent and capable learners. It is important that the facilitator of adult learning help adult students see the connections between earlier learning experiences and new information. Thus, teachers of adults should begin educational sessions by finding out what the adults already know about the topic. For example, knowing whether or not a group of medical students has an understanding of interstitial lung diseases would be helpful to the radiology teacher who plans to show the students radiologic examples of the diseases. A student with no fundamental knowledge of such diseases, who may be unfamiliar with the disease names, would have no current knowledge to tie the radiologic images to.

There are several effective strategies for assessing prior learning (7). One is the *KWL* strategy, in which the teacher asks learners (on a handout) what they already *KNOW* about the topic, what they *WANT* to learn about the topic, and (at the

end of the session) what they did *LEARN* about the topic. Another strategy is a pre-session quiz about the topic. The quiz can be given several days or weeks before a session or at the beginning of the session. When an audience response system is used to test learner knowledge, both the learners and the instructor can find out what learners already know and whether the information they know is accurate. An additional strategy to assess prior learning allows participants to react, in writing, to statements or questions about the topic at the beginning of the session. A discussion of the responses ensues, allowing the instructor to review them with the group and ask for clarification about what was written. Obtaining this kind of information allows the instructor to facilitate an educational activity that has built-in flexibility, allowing on-the-spot changes to address current needs. The information is useless if it is not used to design an educational program that best meets the needs of the learners.

Knowles (4) promoted the concept of self-directed learning. He felt that adults should create personal learning objectives that would allow them to set individual goals and to practice using the new learning in practical ways. Self-initiated learning is the most lasting and pervasive (11). Learning is most effective when adults can proceed at their own pace, so independent study should be encouraged. Independent study can be facilitated by providing learners with references and handouts. Knowles created the concept of a learning contract, which allows participants to identify and write down personal goals and how they feel that these goals could be met. Instructors can share the intended agenda for the learning experience and ask for input from the learners, asking them what they would like to know about the topic. Their suggestions should not be the sole input into development of objectives and educational content. Learners may be unaware of things that they need to know, and the instructor needs to anticipate this based on experience with other learners at similar levels of development. Formal testing is one way to determine what learners do and do not know.

Adults are goal-oriented. They like to know how the educational activity will help them reach their goals. The facilitator should explicitly state this objective at the beginning of the activity. For example, a learner may attend a lecture on high-resolution computed tomography (CT) of the chest, with a goal to understand the different patterns of disease seen on CT scans. At the beginning of the lecture, the instructor outlines seven patterns that will be discussed and contrasted with each other, making it clear to the learner how the lecture will help him or her understand patterns of disease on CT scans in a way that will be applicable to his or her practice. To fulfill this need of adult learners, instructors should create lectures that are organized with clearly defined elements.

Adults desire course content to be relevant and practical. Learning should be applicable to the learner's work or other responsibilities valued by the learner. In other words, adults want to know "what's in it for me" (WIFM). They want content that can be applied to real-life situations. Adults tend to be problem-centered rather than subject-centered learners and learn best through practical applications of what they have learned. To create a problem-centered learning environment, the instructor needs to know what the learner's needs are and to design learning activities that are relevant to those needs. Early in the learning experi-

ence, there should be an opportunity for the learner to identify his or her specific needs. Techniques that can be used to facilitate making content relevant are use of collaborative, authentic problem-solving activities; anticipating problems in the application of the new ideas to the learner's setting and offering suggestions; and using stories to link theory to practice.

All learners need to be respected as individuals. Creating respectful learning environments, in which all opinions are valued, helps to allay any concerns or discomfort. Adults should participate voluntarily. In a true learning community, all participants, including the instructor, share ideas and learn from each other. The instructor is seen as a facilitator or guide rather than the only one with knowledge. Adults respond positively to comfortable physical environments, frequent breaks, snacks, and opportunities to collaborate with others in the session. Learners respond to personal interaction, such as when the instructor calls the learner by name and listens to the learner's questions and viewpoints. The instructor should always be courteous and patient, assuring learners that mistakes are part of the learning process, and should encourage learners to support one another in learning endeavors. Learning takes place in an environment that is considered "safe" by the learner, one in which the learner feels he or she can be successful. An example of an unsafe environment is one in which radiology residents are belittled in front of their peers for not knowing a correct answer. Learners appreciate activities that use time effectively and follow a planned schedule. Otherwise, they feel that their time is not considered valuable. An instructor can create a respectful learning environment by considering what he or she would desire as a learner and treating learners in the same way.

Another aspect of adult learning is motivation, which is both intrinsic and extrinsic. At least six factors serve as sources of motivation for adult learning (12): (a) social relationships (making new friends, meeting a need for associations and friendships), (b) external expectations (complying with instructions from someone else, fulfilling the expectations or recommendations of someone with formal authority), (c) social welfare (improving one's ability to serve mankind, preparing for service to the community, and improving one's ability to participate in community work), (d) personal advancement (achieving higher status in a job, securing professional advancement, and staying abreast of competitors), (e) escape or stimulation (relieving boredom, providing a break in the routine of home or work, and providing a contrast to other exacting details of life), and (f) cognitive interest (learning for the sake of learning, seeking knowledge for its own sake, and

satisfying an inquiring mind). Successful continuing medical education courses provide opportunities for social relationship, personal advancement, and escape or stimulation.

Unlike children, adults have many responsibilities that they must balance against the demands of learning. Because of these responsibilities, adults have barriers against participating in learning (12). Some of these barriers include lack of time, money, confidence, or interest; lack of information about opportunities to learn; scheduling problems; “red tape”; and problems with child care and transportation. Typical motivations include a requirement for competence or licensing, an expected (or realized) promotion, job enrichment, a need to maintain old skills or learn new ones and adapt to job changes, or the need to comply with company directives. The best way to motivate adult learners is to enhance their reasons for participation and decrease the barriers. Instructors can motivate learners by establishing a friendly, open atmosphere of helpfulness and by setting the degree of difficulty of the learning experience high enough to challenge participants but not so high that they become frustrated by information overload.

Teaching is not something that should be done to the learner. The learner should be actively involved in learning and should be encouraged to be active. He or she should be given an opportunity to practice new behavior in a safe, supporting situation. Active participation engages learners in the learning process and enhances retention of new concepts. Active learning techniques include activities that are student-centered (eg, not a “talking head” lecture), encourage sharing of experiences and questioning, and weave discussion sections with exercises that require learners to practice a skill or apply knowledge. In his book *Freedom to Learn*, Carl Rogers (13) distinguished two types of learning: cognitive (meaningless) and experiential (significant). Cognitive is seen as academic knowledge, whereas experiential equates to learning by doing. Rogers saw the qualities of experiential learning as personal involvement, self initiated, evaluated by the learner, and having pervasive effects on the learner.

Transfer of learning is the result of training. It is the ability to use the information taught in the course in a new setting. Positive transference, like positive reinforcement, occurs when the learners use the behavior taught in the course. Negative transference, like negative reinforcement, occurs when the learners no longer do what they are told not to do. Negative transference results in a positive (desired) outcome. Transference is most likely to occur when learners can associate the new information with something that they already

know (association), when the information is similar to material that participants already know (similarity), when the learner’s degree of original learning was high, and when the information learned contains elements that are extremely beneficial on the job (critical attribute element) (12). Radiology review courses are an example of an educational activity in which learners benefit from new knowledge that is based on and reinforces current knowledge that the learner will apply in practice (clinical practice or in a certification examination).

Not all people learn in the same way. Research shows that there are many different learning styles or characteristic ways that adults prefer to learn. Individual learning styles are influenced by personality, intelligence, education, experiences, culture, and sensory and cognitive preferences. To engage all learners, it is best to vary the methods in which information is communicated. These methods can include small- and large-group discussion, role-playing, lecturing, case studies, games, questioning, and varying technology (eg, media, video, computer, interactive). Studies reveal that over a period of 3 days, the retention of learning is 10% of what we read, 20% of what we hear, 30% of what we see (demonstration), 50% of what we see and hear (discussion), 70% of what we say (practice), and 90% of what we say as we do (teach others, immediate use). It follows that an effective learning protocol is to watch one (demonstration), do one (practice), and teach one (use new learning).

There are several different “learning intelligences” or ways in which individuals can learn information. Instructors should attempt to include as many of these different intelligences as possible in the design of their educational activities. These intelligences are linguistic (language and words), logical and mathematical (numbers and problems), spatial (perception of objects through senses), kinesthetic (use of body to learn), interpersonal (social skills, working with others), intrapersonal (learn on one’s own), musical (learning through music), and naturalistic (learning through the natural world).

Boud and Griffin (14) suggest that we have six learning capabilities comparable to the six strings on a guitar. The six strings are rational (we are the most familiar and have the most experience with this capability, as we assume that learning is a rational, intellectual activity), emotional, relational (learning is enhanced through relationships with others), physical (learning can be enhanced or inhibited by our physical state), metaphoric

Table 2
Questions for Educators Seeking to Apply Adult Learning Principles

Principle	Question
Learning is enhanced when it is immediately applicable to real-life contexts.	What are some of the ways you can make training relevant to the learners' practices?
Learning is enhanced when adults have control or influence over the educational experience.	What are some of the ways you can give participants control over their learning?
Learning depends on past and current experiences.	What are some of the ways you can use the learners' experiences as a resource for learning?
Learning depends on active involvement of the learner.	What are some of the ways you can keep learners stimulated and involved?
Learning depends on a climate of respect and comfort.	What are some of the ways you can create a safe, respectful, comfortable learning atmosphere?
Learning is enhanced when learners achieve self-direction.	What are some of the ways you can encourage learners to be more self-directed and to continue learning on the job?
Learning is enhanced when connections are created.	How can you create connections among participants and the workplace?
Learning is enhanced when learners are successful.	What are some of the ways you can help ensure that learners are successful?
Learning is facilitated when learners receive feedback.	What are some of the ways you can reinforce learners and facilitate self, peer, or instructor feedback?

Source.—Reference 7.

(learning can be enhanced through symbol, metaphor, intuition), and spiritual (a deep sense of connection with everyone and everything). Learning experiences occur more often when more of the “guitar strings” are activated.

Providing timely feedback leads to successful learning and mastery of content and skills. Sensitive feedback helps learners correct errors and reinforces good behaviors. As the name implies, positive reinforcement is “good” and reinforces “good” (or positive) behavior. Negative reinforcement is useful in trying to change modes of behavior. The result of negative reinforcement is extinction—that is, the instructor uses negative

reinforcement until the “bad” behavior disappears or becomes extinct. Instructors need to use reinforcement on a frequent and regular basis early in the process to help learners retain what they have learned. The Accreditation Council for Graduate Medical Education (ACGME) requires that radiology residency programs evaluate residents on a quarterly basis and encourages evaluation after every rotation (15). However, residents can benefit from feedback (formal and informal) on a more frequent basis. More frequent feedback is especially beneficial for first-year radiology residents, who may feel insecure about their role and level of competence. Reassurance from the radiology faculty that these feelings are natural and expected can help to create a safe learning environment, one in which the resident is not hesitant to be an active participant.

Self, peers, and instructor can all provide important feedback. Success in achieving objectives facilitates further learning. Critical reflection is an important element of adult learning programs. It has been suggested that people do not learn from experience, but rather they learn from reflecting on experience (7). Writing reflective journals can be helpful in enabling adults to keep track of changes in their behavior or actions as a result of new learning and to keep track of how those changes affect their practice over time. Journals allow adults to chart their own courses and to be aware of their personal growth and development.

Summary

In general, all theories of adult education are based on valuing the prior learning and experience of adults (11). Adult learning requires building on this prior learning, using methods that treat learners with respect, and recognizing that people have different learning styles and have a variety of responsibilities and time commitments. Effective educators also recognize that adults often learn collectively from each other. The optimal role of the adult learner in the learning situation is that of a self-directed, self-motivated manager of personal learning who collaborates as an active participant in the learning process and who takes responsibility for learning. Educators will be more successful if they understand the basic principles of adult learning and apply these principles in their teaching (Table 2).

References

1. Flaxington BD, Cohen LA. Using adult-learning principles to educate employees about investments. *Profit Sharing* 1996; September-October:12-14.
2. Beder HW, Darkenwald GG. Differences between teaching adults and pre-adults: some propositions and findings. *Adult Education* 1982; 32:142-155.
3. Imel S. Teaching adults: is it different? *ERIC Digest No. 82*. Available at: <http://www.ericfacility.net/ericdigests/ed305495.html>. Accessed February 5, 2004.
4. Knowles MS. *The modern practice of adult education: andragogy versus pedagogy*. New York, NY: Association Press, 1970.
5. Knowles MS. *The modern practice of adult education*. Rev ed. Chicago, Ill: Association Press/Follett, 1980.
6. Knowles MS. Introduction: the art and science of helping adults learn. In: *Andragogy in action: applying modern principles of adult learning*. San Francisco, Calif: Jossey-Bass, 1984.
7. Pennsylvania Pathways: Professional Development for Child Caregivers. Training Resource Manual, *Adult Learning Principles*. Available at: http://www.papathways.org/TRM_AdLearnPrinc.htm. Accessed February 5, 2004.
8. Feuer D, Geber B. Second thoughts about adult learning theory. *Training* 25, no. 12 (December 1988):31-39. *ERIC Digest No. EJ 381 416*.
9. Gorham J. A current look at modern practice: perceived and observable similarities and differences on the same teachers in adult and pre-adult classrooms. In: *Proceedings of the 25th Annual Adult Education Research Conference, Raleigh NC, April 5-7, 1984*. (ERIC Document Reproduction Service No. ED 269 554).
10. Gorham J. Differences between teaching adults and pre-adults: a closer look. *Adult Education Quarterly* 1985; 35(4):194-209.
11. O'Brien G. What are the principles of adult learning? Available at: http://www.southernhealth.org/aucpme/articles/adult_learning.htm. Accessed February 5, 2004.
12. Lieb S. Principles of adult learning. Available at: <http://honolulu.hawaii.edu/intranet/committees/FacDevCom/guidebk/teachtip/adults-2.htm>. Accessed February 5, 2004.
13. Rogers CR. *Freedom to learn*. Columbus, Ohio: Merrill, 1969.
14. Boud D, Griffin V, eds. *Appreciating adults learning: from the learner's perspective*. London, England: Kogan Page, 1987.
15. Accreditation Council for Graduate Medical Education Program Requirements for Graduate Medical Education in Diagnostic Radiology. Available at: <http://www.acgme.org>. Accessed July 16, 2004.