Learning:

The Critical Technology®

A whitepaper on adult education in the information age

WAVE TECHNOLOGIES INTERNATIONAL, INC.

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Throughout this paper the more standard word *student* has been replaced with the word learner. Student tends to imply passive acquisition of knowledge, while learner suggests an active role of a person seeking to grow and change. The word *we* refers to learners, worldwide.

Wave deeply appreciates the efforts of Joann Ward, Norma Tedder, Tom Palaskas, Bob Filipczak, Leslie Bivens, Michael Ayers, Dave Ferguson, and Martha Spruitenburg for helping clarify the message. Extended thanks goes to members of the Internet Training and Development discussion list (TRDEV-L) who consistently challenge us to learn more about ourselves and education.

Dear Colleague,

As a technical manager, I'm barraged by information in every imaginable form. Between urgent messages and meetings, I have to keep up with the industry around me and stay on the leading edge of new products and services — a daunting task at best. More often than not, there just isn't enough time to attend formal training classes. Instead, I must find other ways to learn and keep my knowledge current.

I realized there should be a better way. I had already spent years researching technology. **It was time I started studying how to learn faster and more efficiently, while motivating myself to keep learning**.

This started a journey toward learning how to learn. **Specifically, I wanted to know the best way to learn technology and how to design more effective technical instruction.** From my literature search, I found the fields of experiential education, learner-centered learning, and educational psychology. I also discovered that information technology organizations should apply educational principles to their products and services to improve the way consumers understand and use their goods.

The question becomes, **"When will others find time to master these learnings, too?!"** The answer is, "Now!" I condensed, de-jargoned, and compiled the foundations of adult education in order to help you make learning last.

I believe that successful information organizations must become systematic, even organic. Soon, work will no longer be defined by job descriptions, but rather by growing, changing, and evolving sets of projects, programs, and people. What we know and can access **quickly will determine our ability to prioritize, focus, and do the job. Education will be the soul of the new technology industry**. Welcome aboard!

On the road to better understanding,

Marcia L. Conner
Director of Learning Strategies
Wave Technologies International, Inc.

Contents

Congratulations! By deciding to read this paper, you made a wise decision and set yourself on a journey of understanding — understanding the real meaning of learning. This paper contains information that will benefit everyone. Unlike many scholarly works, the benefits are available almost immediately. You may ask, "**How will this help me? Why should I invest valuable time reading this paper?**"

The following is a list of potential benefits. Circle those you wish to learn. As you read through the paper, look for items related to what you circled. Though the list is long, you will find from reading past the list that **the knowledge is within your grasp**.

Learners

- ✓ Determine your primary and secondary processing styles. Knowing them will help you modify your approach to learning.
- ✓ Understand the styles of people you often communicate with so you can get your point across more effectively.
- ✓ Determine if an educator appears to favor one style over another. If so, privately call it to his or her attention (and offer a copy of this whitepaper!).
- ✓ Find out why your retention will increase tenfold by immediately putting to use new information.
- ✓ Learn to start filtering the relevant information from the irrelevant, rather than becoming frustrated with the great volume of technology you want to understand.

Educators

- ✓ Become conscious of the way you address various learning styles in the classroom. Try to balance visual, auditory, kinesthetic, and tactile modes. Offer a balance of class and experiential activities.
- ✓ Understand how traditional behavioral strategies can be detrimental to long-term learning and motivation.
- ✓ Learn to implement a complete-loop methodology in your programs. You are likely to find learner satisfaction increasing and the time you spend defending internal training programs decreasing.
- ✓ Learn how to make *appropriate* use of media and how to avoid the temptation to use a medium simply because it's new. Focus on learner needs.

Education or Training Purchasers

- ✓ Find out why you should insist that any prospective training provider shares their learning methodologies. A lack of methodology may indicate the provider doesn't follow a consistent program or may be limited in their abilities to deliver *complete-loop* programs.
- ✓ Learn to insist on satisfaction guarantees. A training provider that stands behind its beliefs should also be ready to back them up with its wallet.
- ✓ Understand the importance of finding out what worked and what didn't for your learners and why you should care if trainers adhere to their published methodologies.
- ✓ Learn why you should expect training organizations to provide educational opportunities through multiple platforms (instructor-led, self-study, computer-based training) to meet the individual needs and learning styles of your employees.

Senior Executives

- ✓ Most employees view training as a benefit. Learn why you should patiently expect motivation and productivity to increase.
- ✓ Understand that it is a mistake to only send your company's best and brightest employees to evaluate training programs.
- ✓ Learn why you should look for areas within your organization that need people to learn more. Repeated mistakes and lost opportunities are often symptoms of a lack of education.
- ✓ As you set the company's strategic direction, be sure to hire individuals with expertise about the new areas you expect to enter. Help those who need to learn new areas.

There is something in this paper for everyone. Join Wave in learning more about learning.

In a time of drastic change, it is the learners who inherit the future. The learned find themselves equipped to live in a world that no longer exists.

— Eric Hoffer quoted in *Vanguard Management*
(Quoted by Warren Bennis in *On Becoming a Leader*. Reading, MA: Addison-Wesley, 1989.)

At Wave, we believe success within organizations rests on the shoulders of individual learners. Rapid advancements in communication technology and computer-based business tools increase demand for continual education. Without the ability to learn effectively, it is easy to become overwhelmed by the changes taking place and the amount of information we must assimilate each day.

This paper was created to provide the tools necessary to make the process understandable, leaving the learner with fewer obstacles to gaining knowledge. After understanding how we each learn best, we're left with only the task of learning. With an understanding of learning, the constant influx of new information will no longer be overwhelming, rather welcome.

While technology alters the very nature of business, it also changes the way training must be delivered and new learning must occur. **New technology, integrated with experiential education, can and will increase the effectiveness and efficiency of the learning process.**

Critical Success Elements

- ✓ Training programs must capitalize on individuals' learning styles.
- ✓ Learning should be goal-based and training programs must complete the learning loop.
- ✓ We must gain access to training products and programs in a wide variety of media.

Wave believes three changes must transpire for learning to be both effective and successfully integrated into the daily lives of individual workers. In turn, these changes transfer from the individual back to the organization.

First, training programs must capitalize on an individual's learning style. Styles include the way one perceives information, the experiences of the individual, and a person's motives for learning a specific topic. These styles should dictate the appropriate delivery vehicle for instruction. **It's inappropriate to assume all learners have similar styles and can be force-fitted to one delivery strategy.**

Second, Wave believes learning should be goal-based and training programs must *complete the loop.* Training delivery systems must begin with effective needs analysis and testing so that an appropriate training program can be implemented on an individualized basis. Wave's view of complete-loop learning relies heavily on a model of pre-testing, design, delivery, and post-testing.

More than ever, companies require measurable results from training programs. We must measure at what point we start to identify what we accomplish. Only against well-defined baseline competencies can businesses measure advances in learning.

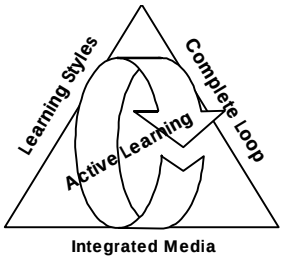
An organization's commitment and capacity for learning can be no greater than that of its members.

— Peter Senge (1990), *The Fifth Discipline*

Third, products and programs must use technology to improve the efficiency and effectiveness of the training delivery process. Wave believes training providers must become intimately involved in computer-based training (CBT).

An integrated media approach is a radical departure from current industry offerings. Today the market contains many vendors, each specializing in a particular delivery format or a narrow range of subject matter. Traditional

instructor-led training, video-based instruction, and computer-based training can work, but have limits the market must address. To truly achieve comprehensive educational goals, training must make use of *every* format and media available in program delivery.



The strength of these three critical success elements draws from their links and connections to one another. How can the learning needs of unique individuals be met with a single medium? Why test competencies before knowing learner motivation? And, why test competencies without knowing how best the learner will process information? What better way to prepare for electronic tests than with computer-based tools that replicate the testing situation? In order for organizations to learn, these questions must be answered.

We must not forget that organizations only learn through individuals who learn. To meet organizational goals, we must meet the needs of learners. While individual learning cannot guarantee organizational learning, without it, no organizational learning occurs.[1] **Individuals must learn for organizations to progress.**

Call To Action

- ✓ Learn more about the way adults learn.
- ✓ Learn what testing methods reflect authentic learning.
- ✓ Learn which media enhance the education process.

To succeed, learners and training vendors must move out of the 'traditional training' box. We must each investigate (1) how adults learn; (2) which testing methodologies reflect authentic learning; (3) and which instructional media enhance motivation, inquiry, collaboration, innovation, and a commitment to lifelong learning.[2]

Lifelong Learning

Before we identify how to meet these goals, we must depart from tradition. Whitepapers represent learning tools. As such, they should begin by testing the learner's working knowledge of the subject, pre-established beliefs, and understandings that underlie that knowledge.

Please take a few minutes to think about each of the following questions. Think about how or where you learned the information. How strongly do you trust your knowledge? What concerns do you have after reflecting on each question?

More specifically — did you attend a class, watch a video or television program, read an article, dialogue, or base your knowledge on years of anecdotal evidence? Have you put your understanding into practice and witnessed it working or watched someone else do the same? Did you see a commercial touting the merits of a program and wonder, "Is this true or

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[1] Peter M. Senge (1990). *The fifth discipline: The art and practice of the learning organization.* New York: Doubleday.

[2] Wave believes that these three elements are not unique to training programs. Learning at all levels can thrive when programs reflect learning styles, complete the learning loop, and integrate a variety of media.

advertising hype?" Perhaps you don't know how you learned the information, but feel confident you did and trust your understanding. When was the last time you thought about the subject and how you could manipulate your current surroundings to retain the most information from the text ahead?

Move through the following questions and see how many you can answer and apply to your work environment. Reflect.

Research indicates that if we want to transfer something from short-term to long-term memory, we should think about it, relate it to other things we know, question it, and transform it into our own words.

How will companies be different in the next decade? How will your job be different in the year 2001?

Do you learn in a different way than you learned as a child? If so, how?

What makes education boring? What makes education interesting?

How can you identify good instructional design? Do the criteria differ with computer-based training?

Which training programs have been your favorites? Which have been your least favorite?

Personal Mastery Defined

- ✓ The ability to consistently realize the results that matter most deeply to us. We do so by committing to our own lifelong learning.
- ✓ The discipline of continually clarifying and deepening our personal vision, focusing our energies, developing patience, and seeing reality objectively.

From the last class you attended, how many class objectives can you recite? If you can name a few, how many have you applied?

What did you know nothing about five years ago, though are expert in today? How did you learn that much?

What are your passions? What topics have you always wanted to learn?

Are you looking forward to learning more about this topic? What else have you done to learn about the way you learn?

Next, if you don't know your primary learning style turn to *Appendix A* and **go through the *Learning Style Assessment.*** This tool offers you an opportunity to learn your personal style so you can employ the most efficient techniques as you read the remainder of the text. After all, matching the content of paper-based resources like this one with your individual style can prove challenging enough. Knowing your strengths, and what you can do to meet challenges, will help you begin a journey of lifelong learning.

If you are a *visual* learner, draw pictures in the margins. Look at the diagrams and then read the text explaining them. Try to envision the topic and people acting out the subject matter.

If you are an *auditory* learner, listen closely to the words you read. Verbalize the questions. Develop an internal dialogue between yourself and the text. Don't be embarrassed to read aloud or talk through the information.

If you are a *kinesthetic* or *tactile* learner, take out a highlighter and a pencil to take notes. Walk around as you read. Hold the paper in your hand, instead of placing it on the table. Transfer information from the text to another medium such as a keyboard or a tablet. Feel the words and ideas. Move along both mentally and physically.

Now, go back to the *Contents* page and look over what we're going to cover. Scan through the remainder of the paper and look at the headers. Glance at the pictures. Focus on things that catch your attention. Read through *Appendix B,* the glossary. Familiarize yourself with the terms used in the adult learning field and in this paper.

Instruction should present a novel event or question that arouses curiosity and motivates learners to engage in the learning process.

Take a few minutes to do this. Anticipating what comes next prepares your mind to receive new information. Looking ahead is not cheating. Previewing helps you become an active participant, a proactive learner. Understanding the scope or big picture will help you comprehend and follow the material. When you are through scanning, come back and we'll begin.

The Information Age

The *information age* was once heralded as a time when workers would gain more hours for leisure. As technology increased, so would productivity. We would take newly found hours and spend them with our families and in our communities. As a result of technology, the world would be a better place.

The world may be a better place, but most workers haven't noticed decreases in their workload. Instead, business has used increased productivity to strengthen the bottom line. Employers expect employees to make sense of greater amounts of information. Ultimately, their ability to benefit from the information will serve as the business' competitive advantage.

In the 1960s, people wanted to communicate with computers. In the 1970s, we learned to work with them, but eventually learned the programs were not what we needed. In the 1980s, computers did what we needed them to do, but they took too long and cost too much. In the 1990s, price has dropped and programs meet our needs. Now we have to learn the advantages of Ethernet, how to access the Internet, and what bandwidth our system requires to run multimedia.

— Michael Ayers (1994)

Sadly, most people have become overwhelmed by the vast amounts of information delivered each day. As a result, each piece of data tends to mean less to us. The cure for feeling thunderstruck requires we learn to evaluate the importance of each piece of data.

We must learn how to organize information so we can retrieve it again, and grasp new concepts that will make a positive difference in life.[3] Individuals with the *best* and the *least* (not necessarily the most) information will ultimately gain and maintain the advantage.[4] We must separate the nice-to-know from the need-to-know.

Before we can do that, **we must understand context and often a larger view of the world than 'data professionals' and 'traditional educators' have had to in the past.**

More than a billion pages of output are generated daily in the U.S.

— Delphi Consulting, Boston (1994)

Who doesn't spend time trying to make sense of information that may not be important? Why continue to rework old models when they don't help us improved results? Why not accept that many of our current strategies don't work and instead evolve?

In 1859 Charles Darwin wrote that evolution requires one to adapt or die. Those who don't adapt become extinct. To stay competitive and make timely decisions we, too, must evolve. We must adapt. We must learn.

Our dilemma is neither new nor strictly a result of more information. John Dewey, an American philosopher, psychologist, and educator at the turn of the century, stated, "Unused resources are human rather than material."[5] Today, we're using technology, but ignoring mental resources.

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[3] C. B. Willis (1994). Learning how to learn. Sunnyvale, CA: Executive Inquiry.

[4] M. Meltzer (1981). *Information: The ultimate management resource.* New York: American Management Association Communications.

[5] From an address given by Dewey at a dinner in his honor in New York City (1939). Full text available from the Giants of philosophy audio classics series, *John Dewey, 1859–1952*. Nashville, TN: Knowledge Products.

Knowledge in the form of an informational commodity indispensable to productive power is already, and will continue to be, a major — perhaps *the* major — stake in the worldwide competition for power. It is conceivable that the nation-states will one day fight for control of information, just as they battled in the past for control over territory, and afterwards for control over access to and exploitation of raw materials and cheap labor.

Jean François Lyotard (1979), *The Postmodern Condition: A Report on Knowledge*

With approximately twenty-five billion transactions per second, the brain is more advanced than any computer humans are likely to devise. Why not learn to put those resources to work more effectively?

Now, more than ever, we need all the help we can get. The e-mail, fax, and voice-mail devices designed to make our lives easier leave us feeling less productive than before. Instead of sitting down at a desk and receiving information in a single form, from a single source, we're bombarded by information from multiple sources, in numerous formats.

Ironically, *technè* (the Greek word from which technology springs) meant the *knowledge* required to get the job done.[6] Over time, ethical and aesthetic dimensions were added, integrating technical skills with the qualities needed to be a good citizen.[7] Things have changed.

It's time we move from the information (overload) age to the knowledge age. To do that, **we must learn how we learn and do so efficiently.** Individuals and organizations must stop viewing education as something that happens only in classrooms. **We must re-focus on people, their learning styles, and their needs.** It's no longer technology we lack, but the ability to capitalize on brain power.

Learning organizations are very much in vogue....It sounds right, but it isn't. The last thing you want to grow is a *learning organization*. First, you need to grow a learning business [that] leverages the economic value of knowledge.

— Stan Davis and Jim Botkin (1994), *The Monster Under The Bed*

Organizations depend on the skills of thinking, experimental inquiry, collaboration, creativity, innovation, and endless learning. Every organization is a product of its members' abilities. We must seize control of how we learn, what we learn, and when we learn. Thomas Hutchinson calls this, "Who needs what by whom?" To overcome feeling overwhelmed we must determine what we need and how to get it.[8]

The Knowledge Age

What Influences Education?

- ✓ Needs and preferences of ***Learner***
- ✓ Needs and preferences of ***Instructor***
- ✓ Needs and preferences of ***Organization***
- ✓ Needs (and preferences) of ***Content***

To gain the knowledge edge, we must re-focus on the needs of individual learners. Four categories influence what adults are taught and how they learn. These include the needs and preferences of the (1) learner, (2) educator, (3) organization, and (4) content. Too often, the needs of the latter three take precedence over the needs of the learner.

The educator may be content doing things over and over the same way. The organization may think that solving the current crisis matters more than improving the process for the future or learning how to avoid the situation next

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[6] C. S. Byrum (1984). *The greek concept of technè*. (ED 251 394)

[7] Sandra Kerka (1993). *Life and work in a technological society*. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education, OSU. (ED 368 892)

[8] Tom Hutchinson (1978). *Community needs analysis methodology*. Unpublished paper, University of Massachusetts. Quoted by Jane K. Vella (1994), *Learning to listen, learning to teach.* San Francisco: Jossey-Bass.

time. The content may prove difficult to offer in a more useful form.[9]

These realities influence all businesses. They assume that smart people will learn despite the obstacles put in our paths.[10] Instruction may ignore the needs of the learners who influence real change. Learners need respect, relevancy, immediacy, safety, praxis (action with reflection), engagement, and active participation. Until educators and organizations understand that and develop content accordingly, learning and growth will suffer.

Learning can be defined as the act, process, or experience of gaining knowledge or skills. *Memory* defines the capacity of storing, retrieving, and acting on that knowledge.[11] Learning helps us move from novice to expert and allows us to gain new knowledge and abilities.

Knowledge is of two kinds. We know a subject or we know where we can find information upon it.

— Samuel Johnson (1775)

Learning also strengthens the brain by building new pathways and increasing connections that we can rely on when we want to learn more. More complex definitions add words such as comprehension and mastery through experience or study.

Physiologically, learning is the formation of *cell assemblies* and *phase sequences*. Children learn by building these assemblies and sequences. Adults spend more time making new arrangements than forming new sequences. Our experience and background allow us to learn new concepts.

No man's knowledge can go beyond his experience.

— John Locke

At the neurological level, any established knowledge (from experience and background) appears to be made up of exceedingly intricate arrangements of cell materials, electrical charges, and chemical elements. Learning requires energy; re-learning and un-learning requires even more. We must access higher brain functions to generate the much-needed energy and unbind the old.[12]

Learn´ing

1. Any increase in knowledge.
2. Memorizing information.
3. Acquiring knowledge for practical use.
4. Abstracting meaning from what we do.
5. A process that allows us to understand.

Our discussion here assumes learning, from the most fundamental to complex, to be (1) any increase in knowledge, (2) memorizing information, (3) acquiring knowledge for practical use, (4) abstracting meaning from what we do, and (5) a process that allows us to understand.[13]

Remarkably, people can learn from the moment of birth. **Learning can and should be a lifelong process**. Learning shouldn't be defined by what happened early in life, only at school.[14] We constantly make sense of our

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[9] Seaman and Fellenz (1989). *Effective strategies for teaching adults*. Columbus, OH: Merrill Publishing.

[10] Chris Argyris (1991, May/June). Teaching smart people how to learn. *Harvard Business Review,* pp. 99–109.

[11] *American heritage dictionary of the english language (1992 ed.).*

[12] Harold D. Lasswell. The changing nature of human nature. *American Journal of Psychoanalysis.* 26 (2), p. 164. Quoted in Alvin Toffler (1970), *Future Shock*.

[13] Robert M. Smith (1991, April). How people become effective learners. *Adult Learning*, p. 11.

[14] Robert L. Steinbach (1993). The Adult Learner: Strategies for Success. Menlo Park, CA: Crisp Publications.

experiences and consistently search for meaning. In essence, we continue to learn.

Though humans like the familiar and are often uncomfortable with change, the brain searches for and responds to novelty. "Ah-ha!" you may think. "That's why I hated freshman English. No novelty!"

Rote learning frustrates us because the brain resists meaningless stimuli. When we invoke the brain's natural capacity to integrate information, however, we can assimilate boundless amounts.

Another "Ah-ha!"? This may explain why sometimes a tough class, one you never thought you would get through, was one of your all-time favorites.

Western society once believed adults didn't learn. Even today, if you ask a group why adults *cannot* learn, it may surprise you how many begin answering the question without challenging the premise. Unfortunately, many adults deny themselves what should be one of the most enriching parts of life because they assume they can't learn.

We can learn from everything the mind perceives (at any age). Our brains build and strengthen neural pathways no matter where we are, no matter what the subject or the context.

In today's business environment, finding *better* ways to learn matters most. Strong minds fuel strong organizations. We must capitalize on our natural styles and then build systems to satisfy needs. Only through an individual learning process can we re-create ourselves and our environments.

Pedagogy and Andragogy

The word education comes from the Latin word *Educare*, which means, "To draw out." Unfortunately, teaching systems have gotten somewhat off track and have been concentrating on pushing information into the students.

— Frank J. Clement (1992)[15]

Pedagogy (pèd-e-go´jê) literally means the art and science of educating children and often is used as a synonym for teaching.[16] More accurately, pedagogy embodies *teacher-focused education.*

In the pedagogic model, teachers assume responsibility for making decisions about what will be learned, how it will be learned, and when it will be learned. Teachers direct learning.

The great teachers of ancient times, from Confucius to Plato, didn't pursue such authoritarian techniques. Major differences exist between what we know of the great teachers' styles, yet **they all saw learning as a process of active inquiry, not passive reception.**[17] Considering this, it is surprising that teacher-focused learning later came to dominate formal education.

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[15] Frank J. Clement (1992). Accelerated Learning Systems. In Harold D. Stolovitch and Erica J. Keeps (Eds.). *Handbook of human performance technology*. San Francisco: Jossey-Bass. ISBN 1-55542-385-X.

[16] Pedagogy from the Greek word *paid,* meaning child, and *agogus* meaning leader of.

[17] Malcolm Knowles (1990). *The adult learner: A neglected species (4th ed.).* Houston, TX: Gulf Publishing. ISBN 0-87201-074-0.

One explanation for the teacher-focused approach goes back to the Calvinists who believed wisdom was evil. They espoused that adults direct, control, and ultimately limit children's learning to keep them innocent.

[The] type of man devoted to the study of wisdom is always most unlucky in everything, and particularly when it comes to procreating children. I imagine this is because Nature wants to ensure that the evils of wisdom shall not spread further throughout mankind.

— Desiderius Erasmus (1509), *Praise of Folly*

Another theory maintains that seventh century schools, organized to prepare young boys for the priesthood, found indoctrination an effective approach to instill beliefs, faith, and ritual. Many centuries later, organized schools adopted a similar approach even though the outcome was supposed to be neither innocence nor a cloistered life.

John Dewey believed formal schooling was falling short of its potential. Dewey emphasized learning through various activities rather than traditional teacher-focused curriculum. He believed children learned more from guided experience than authoritarian instruction. He ascribed to a *learner-focused education* philosophy. He held that learning is life not just preparation for life.[18]

Adult education, too, had fallen victim to teacher-centered models. In 1926, the American Association for Adult Education began and quickly started researching better ways to educate adults. Influenced by Dewey, Eduard C. Lindeman wrote in *The Meaning of Adult Education*:

> Our academic system has grown in reverse order. Subjects and teachers constitute the starting point, [learners] are secondary. In conventional education the [learner] is required to adjust himself to an established curriculum....Too much of learning consists of vicarious substitution of someone else's experience and knowledge. Psychology teaches us that we learn what we do....Experience is the adult learner's living textbook.[19]

It is the supreme art of the teacher to awaken joy in creative expression and knowledge.

— Albert Einstein

Unfortunately, only some of Dewey's and Lindeman's theories seeped into modern classrooms for children or adults. A century after Dewey proposed learner-focused education, most formal education still focuses on the teacher.

As a result, many learners leave school having lost interest in learning. **Even good-intentioned educators can squelch naturally inquisitive instincts by controlling the learning environment.** By adulthood, some people view learning as a chore and a burden.

In an attempt to formulate a comprehensive adult learning theory, Malcolm Knowles, in 1973, published the book *The Adult Learner: A Neglected Species.* Building on the earlier work of Lindeman, Knowles asserted that adults require certain conditions to learn. He borrowed the term *andragogy* (and-rè-go´jê) to define and explain the conditions.[20]

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[18] John Dewey tested and proved his theories in the Laboratory School, established at the University of Chicago in 1896.

[19] Eduard C. Lindeman (1926). *The meaning of adult education.* New York: New Republic.

[20] In *The Adult Learner*, Knowles states, Andragogy is not a new word. It was used in Germany as early as 1833 and has been used extensively during the last decade in Yugoslavia, France and Holland. It is also worth noting that in 1927, Martha Anderson and Eduard Lindeman used the term in a volume titled *Education Through Experience*.

And-rè-go´jê

As adults we should:

- ✓ Assess our needs.
- ✓ Define our goals.
- ✓ Set our objectives.
- ✓ Choose methods and resources for meeting our objectives.
- ✓ Use our own (and one another's) varied experiences as resources for learning.
- ✓ Organize learning experiences around life-tasks.

Andragogy, initially defined as "the art and science of helping adults learn," has taken on a broader meaning since Knowles' first edition. The term currently defines an alternative to pedagogy and refers to learner-focused education for people of all ages.

The andragogic model asserts that five issues be considered and addressed in formal learning. They include (1) letting learners know why something is important to learn, (2) showing learners how to direct themselves through information, and (3) relating the topic to the learners' experiences. In addition, (4) people will not learn until they are ready and motivated to learn. Often this (5) requires helping them overcome inhibitions, behaviors, and beliefs about learning.

Unfortunately, andragogy usually is cited in education texts as the way adults learn. Knowles himself concedes that four of andragogy's five key assumptions apply equally to adults and children. The sole difference is that children have fewer experiences and pre-established beliefs than adults and thus have less to relate.

In the information age, the implications of a move from teacher-centered to learner-centered education are staggering. Postponing or suppressing this move will slow down our ability to learn new technology and gain competitive advantage.

How can we expect to analyze and synthesize so much information if we turn to others to determine what should be learned, how it will be learned, and when it will be learned?

Though our grandchildren or great-grandchildren may be free of pedagogic bias, most adults today are not offered that luxury. **To succeed, we must unlearn our teacher-reliance.**

We must take it upon ourselves to meet our learning needs and demand training providers do the same. To know our demands, we must know how we process information.

Learning Styles

All our knowledge has its origins in our perceptions.
— Leonardo da Vinci

Individuals learn and process information in different ways. We may not have realized this earlier in our learning careers because most of us attended schools where teachers delivered instruction in one way. Most teachers talked to us, and we answered their questions. We then took pencil- and paper-based tests. Schools taught one way and didn't help or encourage us to learn our unique styles.

There are many different ways to classify learning styles. These fall into

general categories: *perceptual modality, information processing,* and *personality patterns.* The categories represent ways to focus on the learner.

Perceptual modalities define biologically-based reactions to our physical environment and represent the way we most efficiently adopt data. We should learn our perception style so we can seek out information in the format we process most directly. Educators should pay attention to modalities to ensure programs strike all physiologic levels.

A manager may erroneously assume an employee is a 'slow learner' when the employee's learning style is simply different from the manager's or the way the job was structured.

Information processing distinguishes between the way we sense, think, solve problems, and remember information. Each of us has a preferred, consistent, distinct way of perceiving, organizing, and retaining information.

Personality patterns focus on attention, emotion, and values. Studying these differences allows us to predict the way we will react and feel about different situations.

You can observe a lot by just watching.
— Yogi Berra

We will spend our time here on perceptual modalities because it has the most implications in education. The other two categories are addressed in *Appendix B.*

Perceptual Modality

Perceptual modality refers to the primary way our bodies take in information. Commonly, researchers identify auditory, visual, kinesthetic, and tactile styles. The field of *accelerated learning* also relies heavily on modality to explain how learners can process information faster.

Howard Gardner established another way of grouping modalities. He asserts there are at least seven modalities or *intelligences* that link to our individual styles.

Gardner suggests humans can be (1) verbal-linguistic (sensitive to the meaning and order of words), (2) musical (sensitive to pitch, melody, rhythm, and tone), (3) logical-mathematical (able to handle chains of reasoning and recognize patterns and order), (4) spatial (perceive the world accurately and try to re-create or transform aspects of that world), (5) bodily-kinesthetic (able to use the body skillfully and handle objects adroitly), (6) interpersonal (understand people and relationships), or (7) intrapersonal (possess access to one's emotional life as a means to understand oneself and others).[21]

Seven Intelligences

1. Verbal-Linguistic
2. Musical
3. Logical-Mathematical
4. Spatial
5. Bodily-Kinesthetic
6. Interpersonal
7. Intrapersonal

While Gardner's work encourages us to think about modality in new and creative ways, a solid grasp of the core modalities applies immediately to everything we do.

Most people retain a dominant and an auxiliary learning modality. We usually rely on those modes to process information at an unconscious level, but

[21] Howard Gardner (1993). *Frames of mind: The theory of multiple intellegences (2nd ed.).* New York: Basic Books.

we may be consciously aware of which modes we prefer. We access through all senses, but generally favor one. We process *visually* (by sight), *auditorally* (by sound), *kinesthetically* (by moving), and *tactilly* (by touch).

***Visual learners* prefer seeing what they are learning.** Pictures and images help them understand ideas and information better than explanations. A drawing may help more than a discussion about the same. When someone explains something to a visual learner, he or she may create a mental picture of what the person talking describes.

Perceptual Modalities

- Visual (by sight)
- Auditory (by sound)
- Kinesthetic (by movement)
- Tactile (by touch)

If you are a visual learner, you may find it helpful to see the person speaking. You may watch a speaker talk, as well as listen to what he or she says.

Many people assume reading is a visual action. Though we see the words, most of us process the information by hearing ourselves say the words. As a result, researchers identify people who prefer to process by reading, *auditory learners*. Others label the readers 'Print-oriented,' aligning them closely with *visual learners*.[22] Visual learners are more shape- and form-oriented. Print-oriented people depend more on words or numbers in their images.

Auditory learners also fall into two categories. **Auditory learners prefer spoken messages.** The less understood auditory learners need to hear *their own* voice to process the information. The more prevalent type, 'Listeners,' most likely did well in school. Out of school too, they remember things said to them and make the information their own. They may even carry on mental dialogues and determine how to continue by thinking back on the words of others.

We spend the first twelve months of our children's lives teaching them to walk and talk and the next twelve years telling them to sit down and shut up.

— **Phyllis Diller**

Conversely, those who need to 'talk it out' often find themselves talking to those around them. In a class setting when the instructor is not asking questions, auditory-verbal processors (talkers) tend to mutter comments to themselves. They are not trying to be disruptive and may not even realize they need to talk. Some researchers go so far as to call these learners 'Interactives.'[23]

While some auditory learners prefer to listen to both themselves and others, mounting evidence suggests the two types are distinct and separate.[24]

***Kinesthetic learners* want to sense the position and movement of what they are working on. Tactile learners want to touch.** "Enough talking and looking," they may say. "Let's work with this stuff. Let's get our hands dirty already." Even if kinesthetic or tactile learners don't get much from the discussion or the written materials, they may catch up and exceed the lesson plan by working through scenarios and labs. Often, they don't thrive in traditional schools because most classrooms don't offer enough opportunity to

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[22] Leslie Shelton, Joan Sheldon-Conan, and Holly Fulghum-Nutters (1992). *Honoring diversity*. Sacramento, CA: California State Library Fund. ISBN 0-929-722-51-5.

[23] Shelton, et al. (1992).

[24] Bob Zenhausern, at the University of St. Johns, is a leading researcher in this field.

move or touch.

Most assessments group kinesthetic and tactile styles together, though they mean different things. Their similarity is that both types perceive information through nerve ends in the skin, as well as organs through muscles, tendons, and joints.

Studies show that single-style classes (where modality indicators segregate a group) can be more effective than classes with diverse-style learners.[25] The non-homogenous approach, however, seems impractical and doesn't lend itself to the various challenges learners face each day.

We can sometimes sense the way people process by listening to the words they use to describe learning situations. For example, a visual learner may say, "I see your point." An auditory learner may instead say, "I hear what you're saying." And a kinesthetic learner may say, "I feel we're moving in the right direction."

Likewise, learners can compensate when the instructional medium doesn't match individual style. Kinesthetic learners may benefit from reading and auditory learners can improve their understanding by touching what they are working on. **Possessing various compensating strategies allows us to benefit under all circumstances.**

As learners, the most important thing we can gather from processing styles is to know our own physiologic preferences and choose instructional media accordingly when possible.

Further, educators and instructional designers need to build courses and programs that address multiple learning styles. Instead of using, "Do unto others as you would have them do unto you," as the Golden Rule of training, it may be more appropriate to say, "Present information to others as they will best learn."

There can be no knowledge without emotion. We may be aware of a truth, yet until we have felt its force, it is not ours. To the cognition of the brain must be added the experience of the soul.

— Arnold Bennet (1897)

Mind, Emotion, Muscle

While we perceive information through our senses, we assimilate it with our minds, emotions, and muscles. **Without processing information at multiple levels, the brain would be overwhelmed with a mass of cognitive matter: information, data, and facts that may seem impossible to comprehend or learn.**[26]

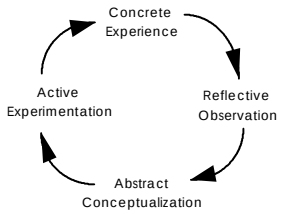
Mind	Think	Cognitive	Ideas	Reflect
Emotion	Feel	Affective	Feeling	Make sense of
Muscle	Do	Psychomotor	Actions	Experiment

Multi-level Approach to Learning

[25] J. Ingham, R. Dunn, L. Deckinger, and G. Geisert (1995–1996). Impact of perceptual preferences on adults' corporate training and achievement. *National Forum on Educational Administration and Supervision Journal, 12 (2).*

[26] Jane K. Vella (1994). *Learning to listen, learning to teach: The power of dialogue in educating adults.* San Francisco: Jossey-Bass.

Most learning involves more than cognitive material (ideas and concepts). Kurt Lewin wrote that little substantive learning takes place without involving something of all three aspects.[27] Learning also involves feeling things about the concepts (emotions) and doing something (action). These elements need not be distinctive. They can be, and often are, integrated.



In the book *Experiential Learning*, David Kolb describes learning as a four-step process. He identifies the steps as (1) watching and (2) thinking (mind), (3) feeling (emotion), and (4) doing (muscle). He draws primarily on the works of Dewey (who emphasized the need for learning to be grounded in experience), Lewin (who stressed the importance of a person's being active in learning), and Jean Piaget (who described intelligence as the result of the interaction of the person and the environment).[28]

Kolb wrote that learners have immediate *concrete experiences* that allow us to reflect on new experience from different perspectives. From these *reflective observations* we engage in *abstract conceptualization*, creating generalizations or principles that integrate our observations into sound theories. Finally, we use these generalizations or theories as guides to further action. *Active experimentation* allows us to test what we learn in new, more complex situations. The result is another concrete experience, but this time at a more complex level.

To be effective learners we must (1) perceive information, (2) reflect on how it will impact some aspect of our life, (3) compare how it fits into our own experiences, and (4) think about how this information offers new ways for us to act. We must realize that learning requires more than seeing, hearing, moving, or touching alone. **We must begin integrating our senses and thoughts with our feelings and actions.**

Active Learning

If you tell me, I will listen.
If you show me, I will see.
If you let me experience, I will learn.

— Lao Tzu (6th Century BC)

While we may each perceive information through different senses, **we ultimately learn by doing**. First we watch and listen to others, then we try doing things on our own. This sparks interest and generates the motivation for self-discovery.

Think back to learning to ride a bicycle, use a computer, dance, or sing. We took an action, saw the consequences of that action, and chose to either continue, or to take a new and different action. What allowed us to master the new skill was active participation in the event and reflection on what we

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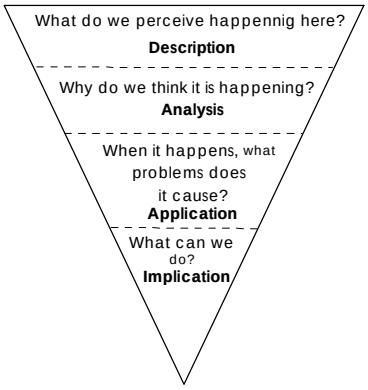
[27] Kurt Lewin (1951). *Field theory in social science*. New York: Harper Collins.

[28] David Kolb (1984). *Experiential learning: Experience as the source of learning and development*. Englewood Cliffs, NJ: Prentice-Hall.

attained. Experience and reflection taught more than any manual or lecture ever could.

Passive learning alone doesn't engage our higher brain functions or stimulate our senses to the point where we integrate our lessons into our existing schemes. We must do something with our knowledge.



Practice to Praxis

Praxis is the Greek word that means action with reflection. (Praxis = Experience + Reflection → Action.) In educational situations, we describe, analyze, apply, and then implement our new learning. When we practice a skill, analyze our practice, and then repeat the practice at a higher level, we move practice to praxis. We learn what we're doing.

'Teaching by pouring in' refers to a medieval belief that we could teach people by drilling holes in the human head and, with a funnel, pour information into the brain. Though we now snicker at that model, we use equally absurd methods today. As long as professors model passive learning to future teachers as acceptable and useful, instructors will be unprepared and unwilling to use other techniques such as experiential learning.

Likewise, because many of us haven't seen other techniques, we don't know what we're missing. **Active learning results in longer-term recall, synthesis, and problem-solving skills than learning by hearing, reading, or watching.** Western education needs to move from a learning-by-telling model to a learning-by-doing model. We must move from passivity to activity. We must learn to extrapolate from our experiences and see how to apply what we've done to new instances.

> Why is it that in spite of the fact that teaching by pouring in, and learning by passive absorption, are universally condemned, [educators] are still so entrenched in practice?... Education is not an affair of 'telling,' and being told, but an active constructive process.
>
> **— John Dewey (1916), *Democracy and Education***

The main reason schools haven't integrated experiential-focused theories into all instruction remains a lack of understanding why and how learning-by-doing works.[29] Educators may recognize that experience teaches real-life skills, but they don't see the connection to learning facts. Most teachers still follow the 'drill-them-and-test-them' school of educational thought.[30]

The problem with experiential learning is that in organizations we may not get to see the outcomes of our actions and, thus, cannot reflect on them to learn. The consequences of our actions may be in the too distant future or affect a part of the organization far removed from ours. Peter Senge reminds us:

> We each have a 'learning horizon,' a breadth of vision in time and space within which we assess our effectiveness. When our actions have consequences beyond our learning horizon, it becomes impossible to learn from direct experience. Herein lies the core learning dilemma that confronts organizations [and thus individuals]. We learn best from experience, but we never directly experience the

[29] Kurt Hahn has also been a pioneer in this field. For more information see Richard Kraft and Mitchell Sakofs (Eds.) (1994). *The theory of experiential education (2nd ed.).* Boulder, CO: Association of Experiential Education.

[30] Roger C. Schank (1994, October). *What we learn when we learn by doing*. Technical Report 60. Evanston, IL: Northwestern University's The Institute for the Learning Sciences.

consequences of many of our most important decisions.[31]

Passive learning is called indoctrination. When we think critically we become active learners. Instructional products must challenge learners to be active participants in the knowledge construction process, rather than passive recipients of 'pre-packaged' knowledge.

— Joann Ward (1995)

We must find ways to learn-by-doing and be able to reflect on what happened. Praxis makes the difference.

Simulations

While active learning is often ideal, sometimes it doesn't offer what we need. Other times it's not even possible. The cost of learning-by-doing may be too risky for economics and safety. Equipment may be too expensive or unsafe for novices to use. In such instances, simulations can be designed and implemented to reflect actual doing.

An example you may be familiar with is the elaborate simulations that revolutionized pilot training. While airplane simulators are wildly expensive, work-based simulators need not be. Simulations may save learners the embarrassment and frustration often experienced when learning. In this case, they also save lives.

Learning is more effective when it is an active rather than a passive process.

— Kurt Lewin (1951), *Field Theory in Social Science*

A lab facility, where a new network administrator can configure and upgrade a non-mission critical personal computer until he or she knows how to do it successfully often costs less than the data (or time) lost in a potential accident.

Learning-by-doing opportunities can be set up on-site or on the premises of training companies offering lab or simulation services. The most useful labs provide an opportunity to work on similar equipment or in situations closely matching the real thing.

Simulations also work well for non-equipment-based scenarios. Before conducting a performance review or speaking in front of a crowd, wouldn't you like to rehearse? Wouldn't you be more successful if you had a chance to get comments and try again?

Andersen Consulting, in partnership with Northwestern University's Institute for the Learning Sciences, takes simulations a few steps further. Their *case-based reasoning* software may affect us all soon.

Case-based reasoning software, an invention of Roger Schank, director of the Institute, is software that searches relevant *cases* much the same way a doctor or lawyer might look for relevant precedence. The software identifies the situation closest to the problem at hand.

The learner works through a problem by having conversations along the way with people captured on video who have experience with those cases. Voices, faces, and expressions of experts have been recorded and indexed to appear and assist at the time when the learner makes a mistake or has a question.

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[31] Senge (1990).

On-screen experts also share relevant facts appropriate to the dilemmas and situations to help build the learner's internal knowledge-base.[32] This real-time, hands-on approach keeps learners' motivation strong and more naturally reflects how people learn.

Motivation is never a problem when simulations and labs offer learning on an 'as-needed' basis and allow learners to see their outcomes. We learn because we want to know.

Interaction

Human beings are social animals and education has historically been a social event. As a result, we shouldn't ignore the role of interaction in lifelong learning.

After trying to put computer-based training and just-in-time learning programs into practice, organizations discovered they don't always help employees learn. Products often end up on a shelf and employees ask to go back to traditional classes.

The goal of education should be learning. The end of learning should be mastery. Mastery requires knowing what you know and how to learn more. We must take information, make it our own. Use it.

For too long we blamed the learner, labeling them not-motivated or worse. Managers didn't realize that the software or program could be draining employees' motivation. Historically (and sadly even today) **just-in-time learning programs didn't offer a motivational environment or involve interaction.** Learning suffered.

According to Stephen Brookfield, we need interaction to challenge our beliefs and understandings. "Challenge is the prelude to, and necessary accompaniment of, significant learning." Without it, we don't go far.

Learning requires us to move beyond where we are now. We must move into unfamiliar, often uncomfortable domains. While we're learning we may even feel uneasy. In hindsight we may see the experience as productive. During the uncomfortable part, we may choose to retreat and decide learning may not be worth the risk. Our fear outweighs our incentive for learning something.

Classroom learning is sometimes more comfortable and used because people tend to be more persuasive than books or computers. Some learners find the social aspect the captivating motivator. Teachers explain why we should learn something. Self-directed and risk-taking learners may forgo this step and jump in without even knowing why. Those who tend to avoid conflict may prefer a helping hand or directing voice.

While some people are intrinsically self-directed, many others haven't developed those skills and seek interaction as a prompt to learning. Even

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[32] Educom Review (1995, January/February). Roger C. Schank: End run to the goal line. *Educom Review*, pp. 14–17.

[33] Stephen D. Brookfield (1992, April). Why can't I get this right? *Adult Learning*, p.12.

within an individual, some activities may bring out more self-direction than others. Because we spent the first twelve or so years of our lives in teacher-centered schools, learners often need to learn how to be self-directed.

Interaction between the instructor and learner can make up for a lack of self-direction. Instructors should transfer control back to the learner gradually, but as soon as possible. The instructor should raise the demands made on the learners and then fade into the background, becoming less a directing authority and more a collaborative coach.

Fall 1994 the Masie Center, run by computer-training guru Elliott Masie, went on-line with 4,000 people worldwide in a class on computer training. There was no one to show participants how to do new things, but plenty of opportunity to interact and learn.

In a classroom, an instructor may help the learners through several exercises. Soon, though, the instructor has a responsibility to show learners where to find the remainder of the information on their own. As the learners attain higher levels of competency in such exercises, the instructor can walk around the room and answer questions. As the session progresses, the instructor may sit down and be available when needed.

These techniques also work for self-study programs (paper or computer-based). At first, they may contain specific instructions for exercises and offer very linear agendas. Gradually, the focus should shift to several alternate paths with multiple methods to solve a problem. As learners follow these paths, they build internal structures and eventually master the topics.

This is the same path that experts use. Technical gurus typically become experts because they try new things, push products and systems to their limits, and take risks.

Classes developed for novices rarely involve any interaction or challenge — the very things needed to become experts. We crave the interaction and opportunity to investigate the materials.

New just-in-time learning programs, self-study courses, and classroom training should offer direction when needed, ease off as soon as possible, provide challenge, and allow us to explore.

Motivation

Motivational Styles

1. ***Goal-oriented learners*:** Use education to accomplish objectives.
2. ***Activity-oriented learners:*** Take part because of social contact.
3. ***Learning-oriented learners:*** Seek knowledge for its own sake.

Adults engage in continual education for various reasons. Our unique motivations help us stay focused and stick with a topic until we solve the current problem and gather enough information to complete our current task.

Cyril O. Houle conducted one of the most famous studies on what motivates learners. He identified three subgroups to categorize motivational styles. (1) *Goal-oriented learners* use education to accomplish fairly clear-cut objectives. (2) *Activity-oriented learners* take part mainly because of the social contact. Houle wrote, “Their selection of any activity was essentially based on the amount and kind of human relationships it would yield.” (3) *Learning-oriented learners* seek knowledge for its own sake. “For the most part, they are avid readers and have been since childhood....and they choose jobs and make

other decisions in life in terms of the potential for growth which they offer."[34]

Allen Tough simplified Houle's motivational model by suggesting that adults learn because of (1) an increase in self-esteem, (2) a sense of pleasing and impressing others, and (3) certain pleasures or satisfactions.[35]

Learning Motivations

- ✓ Increase self-esteem.
- ✓ Please and impress others.
- ✓ Find pleasure or satisfaction.

Recognizing our unique motivational styles can also help us identify the types of educational products and problems that will satisfy our needs. For instance, self-study programs are not going to motivate 'activity-oriented' learners unless the program contains some element of interaction. The more social the situation the better.

As certain things motivate, others discourage. Few things are more de-motivating than fear. Learning is, after all, a very emotional process. We must see, feel, and do. Fear, anxiety, and anger are emotional factors that negatively impact learning. On a physical level, stress can even cause cell assemblies to fire in unorganized patterns and ultimately inhibit transfer and retrieval. Our phase sequences can be in chaos.

Also, who likes learning something boring? If we don't care about a topic we're less likely to stick with it and continue to learn. Even when we're interested in learning a topic, we're sometimes *more* motivated to play with the equipment or to daydream. We can get easily distracted from the task at hand and become more motivated to do something else perhaps not on task.

When we first moved to Brussels, we took French lessons. They had immediacy and relevancy to our current life-tasks. After the arrival of a new computer, we took a couple of classes in MS-DOS. When the kids came for winter break, I finally found and shopped the Christkindles markets while they took lessons in downhill skiing. The following year I took a class in systems analysis. That winter I took cross-country skiing. Each served an immediate need. All were relevant.

— Martha Spruitenburg (1995)

The big issues are relevancy and immediacy. Information has to be relevant to our current wants and needs, and it must feel useful to us. Most people don't have time to waste. We want to spend time learning what will make a difference now.[36]

In one of the earliest studies of why adults volunteer for education activities, most said they do so to acquire the necessary knowledge and skills for vocational and professional advancement.[37] While today another common reason may be to stay ahead of the influx of information in our jobs, career success motivates us to learn. No matter the motivator, **if we can learn more of what we want and less of what we don't, learning becomes more appealing.**

Educational Psychology

Educational psychology is the branch of psychology focused on the development of effective teaching techniques and the assessment of learners' aptitudes and progress. A look at adult education wouldn't be complete

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[34] Cyril O. Houle (1961). *The inquiring mind*. Madison, WI: University of Wisconsin Press.

[35] Allen Tough (1979). *The adult's learning projects*. Toronto: Ontario Institute for Studies in Education.

[36] Vella (1994). p. 16.

[37] J. W.C. Johnstone and R. J. Rivera (1965). *Volunteers for learning*. Chicago: Aldine Publishing.

without a view of the theories shaping the way we learn and the way we teach.

While we may be aware that various theories exist, few technology professionals, and even fewer consumers, are aware of the differences between the theories and how they affect the way we learn.

This glimpse into the different theories introduces the principle names, theories, and implications of each approach. Full explanations follow the summaries. With this knowledge, we can identify which theory is appropriate for our needs and which we should look to when evaluating instructional programs.

Brains are in; heavy lifting is out. That's the essential nature of the new, knowledge-based economy. Therefore, the development of knowledge is close to job No. 1 for corporations....The challenge is only 5 percent bits and bytes (a spiffy e-mail system that spans continents, for example); it's 95 percent psychology and sociology — an organization that dotes on sharing information rather than hoarding it.

— Tom Peters (1994), *The Pursuit of WOW!*[38]

Behavioral psychology states that behavior can change as a result of extrinsic motivators such as incentives, rewards, and punishments. Behaviorists advocate influencing behavior through the systematic adjustments of stimulus-response reinforcements.

Most research in the field is based on B. F. Skinner's work in the early 1930s. He concluded that by controlling the environment of mice in a lab he could 'train' them to behave consistently. From this research came theories designed to train humans.

Behavioral instruction hinges on the use of observable, measurable, and controllable *objectives.* A teacher (or organization) determines what objectives the learner should achieve. These objectives are met when the learner responds in a certain way, based on controlled stimuli.

Cognitive psychology holds that information is more likely to be acquired, retained, and retrieved for future use if it is learner-constructed, relevant, and built upon prior knowledge.

Cognitivists are concerned with the study of individuals' perceptual processes, problem-solving abilities, and reasoning abilities. Cognitive programs are often organized in *chunks*, and have built-in or learner-generated memory devices to help learners retain and use the information in the future.

Cognitive models give learners control by introducing conceptual frameworks, and by relying on both *experiential* and *discovery learning.*[39]

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[38] Tom Peters (1994). *The pursuit of WOW!: Every person's guide to topsy-turvy times.* New York: Vintage Books. p. 16.

[39] Discussion Paper Series. *Instructional principles for adult learning*. Bedford, MA: National Education Training Group – Spectrum.

Constructivist psychology tells us that learners do not simply absorb and store information. We make tentative interpretations of experiences and go on to elaborate and test what we determine. Our mental structures are formed, elaborated on, and tested until we establish a satisfactory structure.

Constructivists report that people are *active* and don't only respond to stimuli as behaviorists suggest. We engage, grapple, and seek to make sense.

Humanist psychology focuses on individual growth and development. It stems from the theory that learning occurs primarily through reflection on personal experience, and as a result of intrinsic motivation. Humanists uphold the andragogic belief that significant learning leads to insights and understanding of ourselves and others.

Humanist instruction involves learners in all stages, including planning to ensure that we understand the relevance of topics. These programs rely on self-analysis, team building, learner evaluation, and peer learning using various tools and approaches.

Traditional ISD [instructional system design] models (both analysis procedures and outcomes) may not be adequate for acquiring and structuring knowledge as these environments require. In addition to motivation, affect, and cognition, new approaches will have to contend with such issues as interactivity and integration of learning and work.

— Jesús Vázquez-Abad and Laura R. Winer (1992)[40]

For instructional design to work, methods must match and support goals. Each approach offers advantages and disadvantages. Some programs successfully integrate aspects of different models. Instruction needs to make use of research and be grounded in sound educational theory. If programs are created without an instructional model or ignore what is known about educational theory, we leave learning to chance.

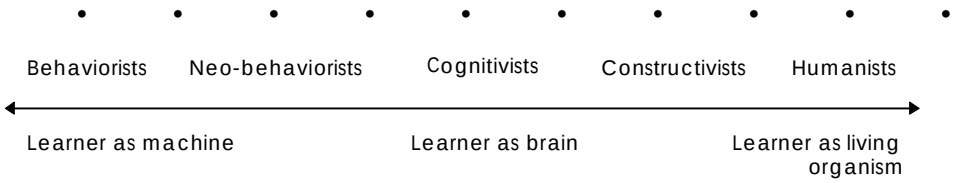
Educational psychology is steeped in controversy. Though each theory has elaborate research behind it, most organized instruction has been based on one model: Behaviorism.

To take advantage of the other very useful approaches, we must overcome strong biases and beliefs. If we accept that the old ways of working are no longer complete answers in the information age, **we should amplify the number of approaches we use to learn.** We must evolve.

The following continuum charts how behavioral, neo-behavioral,[41] cognitive, constructivist, and humanist theories view learners.

[40] Jesús Vázquez-Abad and Laura R. Winer (1992). emerging trends in instructional interventions. In Harold D. Stolovitch and Erica J. Keeps (Eds.), *Handbook of human performance technology*. San Francisco: Jossey-Bass. ISBN 1-55542-385-X.

[41] Neo-behaviorism is defined and explained in *Appendix B.*



In short, behaviorists view learners as mechanical responders; cognitivists understand us as cerebral thinkers; and humanists work with us as changing individuals. While instruction nears the right end of the continuum, we benefit from the andragogical principles that rose out of humanism.

Education is what survives when what has been learnt has been forgotten.

— B. F. Skinner

The chart lists the prominent researchers in each area and some defining terms associated with each theory.[42]

Theory	*Behaviorism*	*Neo-behaviorism*	*Cognitivism*	*Constructivism*	*Humanism*
Theorists	Skinner Thorndike Watson	Hebb Hull Bandura	Piaget Gagné Bruner Ausubel	Piaget Papert	Rogers Maslow Knowles Vella
Role of instructor	Behavior modifier	Source, model, and prompter	Prompter, disseminator of information	Dialogue facilitator, prompter, challenger	Facilitator, coach, listener, partner
Level of structure	High level	High level	Moderate level	Low level	Varying level depending on learner needs
Processing required	Low conceptual levels	Low conceptual levels	Moderate conceptual levels	High conceptual levels	High conceptual levels

Behaviorism

A fable.

A scientist put a laboratory mouse in a box with six rooms. The mouse soon learned the cheese was in room three. Therefore, it always ran directly to room three upon being put in the box. One day the scientist put the cheese in room five. Upon entering the box, the mouse ran directly to room three. "Hmmm...no cheese." The mouse looked around. Tried room four. No cheese. Tried room five. "Ah-ha! Cheese!"

What would a human being have done? He or she would have continued to return to room three again and again and again — expecting and then demanding cheese. "Where is my cheese!? This is where it has always been. It's supposed to be here! I want it NOW — GIVE ME MY CHEESE!!! I have rights you know. Blah, blah, blah." And so the complaining was heard through the night in the now-dark laboratory. Meanwhile, the cheese remained in room five.

So what is the difference between mice and people? Mice get their cheese.

— Author unknown

[42] Adapted from S. S. Dubin and M. Okun (1973). Implications of learning theories for adult instruction. *Adult Education, 24* (1). p. 8.

The fable reflects a society dependent upon rewards and external praise as viable methods to alter behavior. Even though our organizations require more advanced information processing skills, behaviorism is so pervasive that most of us don't question its validity or use in our lives. Because of this bond, it would be naive to assert we should stop using behavioral instruction altogether.

Behaviorist Methods

- ✓ Teachers provide stimulus for learners to respond to in specific, predetermined, measurable ways.
- ✓ Activities are sequenced so that learners move through a series of carefully designed, progressively complex operations.
- ✓ Learners are evaluated as successful when the defined learning objectives are achieved

Behaviorism suggests that (1) teachers ensure learners attain defined learning objectives, usually specified as observable, behavioral outcomes. (2) Learning activities are sequenced so that learners move through a series of carefully designed, progressively complex operations. (3) Educational activities are evaluated as successful when the defined learning objectives are achieved.[43]

Many educators don't realize B. F. Skinner said shortly before his death in 1990, "**The worst mistake my generation has made is to treat people as if they were rats**."

The fact that Skinner, himself, recanted his basic premise has had little effect on those who persist in thinking of minds as vessels to be filled with disconnected facts.[44] **Behaviorism still dominates formal education despite mounting evidence that it leads to long-term problems and few short-term gains.**

First, do what *I want* you to do. Then, you may do what *you want* to do.

— A mom

When has behaviorism *not* dominated our lives? Most of us were raised in families offering tokens for completing tasks. We grew accustomed to external rewards and altered our behavior to acquire more.

Schools carried this approach forward by offering grades, stars, and attention based on the way we behaved. Shrewd students noticed that well-behaved children were treated better than those who misbehaved. As adults, companies pay and provide bonuses to those who follow the rules.

Entrenched in behaviorism, you may even be wondering, "What's the problem?" Many of us only change our behavior, challenge what we know or think, and try something new when a 'carrot' dangles before our eyes.

If we didn't compete in the market, would businesses be re-engineering their tried-and-true work practices? Would we be wanting to learn about learning if we didn't know it would bring us some financial gain?

Most of us don't ask ourselves why we do things and what we want to do differently in the future. We lock into routine tasks and low-level processing.

This cycle continues because we learned to rely on *drill and practice*, the most common behavioral method for teaching new facts and responses. Do

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[43] Stephen D. Brookfield (1989). Facilitating adult learning. In Sharan B. Merriam and P. M. Cunningham (Eds.), *Handbook of adult and continuing education*. San Francisco: Jossey-Bass.

[44] David Thornburg (1994, September). Killing the fatted calf: Skinner recanted behaviorism. Why can't education? *Electronic Learning*, p. 24.

something enough and it stays with you for a lifetime. Control what we practice and teachers control what we learn.

If we keep doing what we're doing, we'll keep getting what we got.
— David Thornburg (1994)

Behavioral instruction offers little opportunity or context to develop independent thought. Behaviorists haven't proven that condition and response techniques transfer to other situations or materials.

Adult education often capitalizes on these despite the facts. Authors, such as Robert Mager, advocate behavioral objectives that break tasks into small, measurable pieces. His books profoundly influence the instructional technology field despite the fact they can instruct educators to measure things too narrowly. They teach novice instructional designers a limiting approach to development.

It's not that Mager encourages anyone to do anything wrong. Without the requisite expertise in instructional design, however, readers may not know when these approaches shouldn't be used. They may not have a thorough enough understanding of their changing business needs to know when this approach will end up inhibiting learning. As a result they may use this methodology in all of their courses.

Ever wonder why we educate people and train dogs and ponies?
— Kevin McVicker (1995)

Behavioral objectives, sometimes referred to as performance objectives, learning objectives, or terminal objectives, inform learners know what will be measured. This type of objective reflects the belief that at a pre-determined, externally controlled time, a learner will know or be able to do something new. The time and place are vital because the test of a behavioral objective lies in its ability to be measured. Often you need to, "Define two of this" or "Name twelve of that."

Measuring is not the problem. After all, who hasn't heard the phrase, "What is measured gets done"? **Limiting the working knowledge of a subject to a finite number of tasks or facts**, however, **seems misguided in many cases.**

Programs that begin by defining what we'll learn can shut down our natural curiosities and sense of wonderment... the very thing that leads to natural change and critical thinking.

To give the illusion of testing something useful, objectives may state something such as, "The learner will be able to identify the correct actions to take when such and such happens." This approach is only useful when learners continue to do those specific actions.

Using behavioral objectives allows training departments to report they've succeeded in educating. "We did it!" they may declare. "Your employee learned. We're useful." Instead, the department has only demonstrated that when they provided a stimulus, the employee responded in a programmed way.

The behavioral approach to instructional design is teacher-centered. An instructor who makes unilateral decisions, regardless of their merits, is in effect saying that the class doesn't belong to the learners. People don't usually cheer

when things are done to them.[45]

Authentic learning and lasting behavioral change comes as a result of adapting to our environment and experiencing new things. To evolve, we must be flexible and adaptable when needed.

Think back on the last class you attended. How many class objectives can you name? How many have you used since then?

Testing from behavioral objectives proves just as problematic. **Drill and practice programs are only moderately effective at increasing test scores and reinforce educational practices with little bearing on the modern workplace.**

Employers don't need performers who can pass tests. They need people who get the job done. It would be more profitable to measure employee's ability to adapt and evolve as things change.

We need learners who have acquired a very different skill set than those required to solve multiple choice problems under the pressure of a stopwatch.[46] Education programs should expose us to new models, help us see things in new ways, and build links so we know where to find additional information when we needed it.

Does this imply there is no place in the field of adult education for behaviorism? Not quite. There are some tasks that lend themselves to drill and practice, as well as condition and response.

Stephen Brookfield, a leading adult education theorist, wrote in *Facilitating Adult Learning*:

> [Behaviorism] is seen most prominently in contexts where the objectives to be attained are unambiguous, where their attainment can be judged according to commonly agreed upon criteria of successful performance, and where a clear imbalance exists between teachers' and learners' areas of expertise. Examples might be learning to give an injection, learning a computer program, learning accountancy procedures, learning to swim, or learning to operate a sophisticated machine. Although no learning is without elements of reflection or emotive dimensions, these examples are all located primarily in the domain of task-oriented, instrumental learning, and it is this domain that fits most easily with the behaviorist approach.[47]

No one can learn all there is to know. The subject is just too big. Besides that, it changes every day.

— Mark Twain (1883), on being a river boat pilot on the Mississippi

There are few examples in business today, however, where objectives are unambiguous and success can be commonly agreed upon by the learner, the teacher, the organization, and the content. In the information age, rules change daily. If we face variation, we may need a different approach.

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[45] Alfie Kohn (1993). *Punished by rewards: The trouble with gold stars, incentive plans, A's, praise, and other bribes.* Boston: Houghton Mifflin.

[46] Thornburg (1994).

[47] Brookfield (1989).

Cognitivism

> Teaching methods based on research in cognitive science are the educational equivalents of the polio vaccine and penicillin. Yet, few outside the educational research community are aware of these breakthroughs or understand the research that makes them possible.
>
> — John T. Bruer, *The Mind's Journey from Novice to Expert*[48]

Cognitive Methods

- ✓ Build on previous knowledge.
- ✓ Self-test and question.
- ✓ Develop meaningful organizations.
- ✓ Discover.

Cognitive psychology is the study of how our minds work, how we think, how we remember, and ultimately, how we learn. There is more to education than cognition, but studying what goes on in the brain can drive progress, help us make decisions, and improve educational programs.

Our innate cognitive architecture remains the same no matter what subject we try to master. Learning about that structure can improve the way we learn. **The implications are staggering for learning technologies based on how the brain deals with ideas.**

The study began in 1965 when psychologists, linguists, and computer scientists met at the Massachusetts Institute of Technology for a symposium on information science.[49] The three-day meeting started the cognitive revolution in psychology, a revolution replacing behaviorist psychology with a 'science of the mind.' The revolutionaries maintained that human minds and computers are similar enough that a single theory — the theory of computation — could guide research in both psychology and computer science.

They know enough who knows how to learn.
— Henry Brooks Adams

"The basic point of view inhabiting our work," wrote two of the participants, "has been that the programmed computer and human problem-solver are both species belonging to the same genus IP."[51] Both are species of the genus *information-processors.* Both are devices that process symbols.[52]

Organization provides learners with a meaningful cognitive structure for storing subject matter. Instruction should encourage learners to develop their own organization, but initially, learners usually find an overview useful.
— David Ausubel (1977)[50]

Cognitivists describe learning as the building of an internal schema (knowledge structure) or the modification and extension of existing *schemata.* Our schemes consistently evolve with use. In time, certain actions require little or no thought. The actions become automatic.[53]

Education doesn't always distinguish between what we should memorize and what we need to comprehend. Programs don't address the need

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[48] John T. Bruer (1993, Summer). The mind's journey from novice to expert. *American Educator,* p. 7.

[49] Howard Gardner (1985). *The mind's new science: History of the cognitive revolution*. New York: Basic Books.

[50] David Ausubel (1977). The facilitation of meaningful verbal meaning in the classroom. *Educational Psychologist, 12*, pp. 162–178.

[51] Allen Newell and Herbert Simon (1972). *Human problem solving*. Englewood Cliffs, NJ: Prentice-Hall.

[52] Bruer (1993).

[53] Rob Forshay (1991, May). Sharpen up your schemata. *Data Training*, p. 20.

for different learning strategies.

Cognitivists view learning as a developmental process. We test our notions about the world against new information before we make it our own. **Our prior experience, knowledge, and expectations are key to learning.**

Make the most of your working memories by organizing materials into chunks or logical groupings of information.

We build bridges between new information and what we already know. Educational programs help us do this by offering meaningful organization and contexts to store and retrieve new information. As a result, we effectively build on what we know.

Children follow this model intuitively when they learn to walk. First they roll over. Then they sit up; next pull up. They try to balance, using their arms, feet, and trunk. Once they master balance, they let go, then take one step, and fall. Not liking the feeling of falling, they try to step again and put the other foot out to balance. After two steps, they try three. Soon they can run.

In the cognitive model, learning is the process for novices to become experts.[54] They differ in understanding, storing, recalling, and manipulating knowledge as they solve problems.[55] Novices and experts differ in their problem-solving behavior, not just in the knowledge they possess.

A well-tested psychological principle indicates that people can hold about seven 'bits' of information, plus or minus two, in working memory. That is why U.S. telephone numbers are seven digits long. Likewise, we naturally chunk information we know into parts for efficient storage.

Novices hold naive theories about how things work. For example, computer novices may fear they will break the machine. Children often think teachers don't go to the bathroom! Highly educated adults used to think the moon was made of cheese. These theories don't reflect the novices' intelligence, but rather their lack of necessary information and experience.

These theories so influence how we interpret instruction that even directions can be ineffective when we're new to a subject. For instance, programs are often designed with input from subject matter experts (SME) who offer how they currently perform tasks or solve problems.

Building new structures in the brain is a biological (chemical/electrical) process. Time is required for cells to assemble. To ensure the system has enough time, instruction must allow new information to settle.

Wanting to share their wisdom, experts can leave out the vital chunks and situations that led them to that expert level. They identify the behaviors that learners should possess and envision reinforcing activities for the novices. A better way to develop curricula based on cognitive research would be to build from, address, and then correct these naive theories so that learners can overcome their naive beliefs.

Novices see individual parts. Experts, in contrast, see *chunks* of relevant information. The experts' more effective, more information-rich chunks allow them to see a larger scope and choose more appropriate areas to turn their attention. Because of this *chunking*, experts process more and better information in the same amount of time.[56]

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[54] Bruer (1993).

[55] An expert is defined as someone highly skilled or knowledgeable in a given topic.

[56] Newell and Simon (1972).

Novices and experts learn by altering long-term memory structures. Cognitive psychology suggests that if education helps novices structure their new information, they will be able to use the structures throughout the life of that knowledge. Unlike behavioral 'condition and response' techniques, these mental structures can even adapt and grow.

We modify these structures when we come across problems that our current rules (or *scripts*) can't solve. We recognize the information we need and process it to build more accurate or up-to-date rules.

Some learners modify their structures automatically while others need some help. Learners who can't modify on their own need direct instruction about the relevant facts and about the strategies to use. With the right approach, we can progress from relative naiveté, through a series of partial understandings, to eventual subject mastery by understanding facts, strategies, and when to use each.

Analogies relate unfamiliar new concepts to familiar ones. A terrific analogy for the information age is, "Passwords are like toothbrushes. Change them often. Never share."

In the early 1980s, researchers noticed that **some people learn new subjects and solved new problems more expertly than most** regardless of how much knowledge they possess on the topic. Called ***intelligent novices***, these people **seem to control and monitor their thought processes**. This suggests that there is more to expert performance than topic-specific knowledge and skills.

Keys to Metacognition

- ✓ Identify the difference between understanding and memorizing material.
- ✓ See which mental strategies to use.
- ✓ Recognize which topics are difficult.
- ✓ Figure out where to start and how much time to spend.
- ✓ Take problems and examples from the materials, order them, and then try to solve them.
- ✓ Pay attention to when we don't understand, so we can seek help from an expert.
- ✓ Identify when the expert's explanation solves our immediate learning problem.

Cognitive psychologists called this new element of expert performance *metacognition*. **Metacognition defines the ability to think about thinking, to be consciously aware of ourselves as problem solvers, and to monitor and control our mental processing.** When we think about how we think, we can reflect on our learning styles, what methods and techniques work best for us, and how we've successfully learned in the past.

There are several keys to metacognition. They include (1) our awareness of the difference between understanding and memorizing material and which mental strategies to use at different times; (2) our ability to recognize difficult subjects, where to start, and how much time to spend on them; and (3) our aptness to take problems and examples from the materials, order them, and then try to solve them. Others are (4) knowing when we don't understand so we can seek help from an expert; and (5) knowing when the expert's explanation solves our immediate learning obstacle.

Metacognitive skills all involve problem solving awareness and control. We can learn metacognitive skills by working through one topic, but can then apply them when trying to learn a second topic.[57]

This research tells us that **metacognition is probably the most important lifelong learning skill.** Incorporating these skills into educational

[57] A. L. Brown, J. D. Bransford, R. A. Ferrara, and J. C. Camione (1983). Learning, remembering, and understanding. In P. H. Mussen (Ed.), *Handbook of child psychology*, *vol. 3, Cognitive development.* New York: Wiley.

programs (and our day-to-day work habits) is vital to our growth. While topic-specific knowledge and skills are essential to expertise, programs must also be metacognitively aware, informed, and explicit.

We need to create and maintain educational environments where learners smoothly journey from novice to expert and learn to become intelligent novices. To do that, we must rethink (or at least re-evaluate) education policy, classroom practices, standards, and teacher training.

Admittedly, we don't know everything about how the mind works, how people best learn, or how to design the best training programs. On the other hand, **cognitive science shows us strategies we can apply to improve our programs and our futures.**

Constructivism

New Approach to Learning

- ✓ Collaborate.
- ✓ Draw wisdom from data.
- ✓ Articulate beliefs and why we believe it.
- ✓ Be willing to gather new information when it's time to change what we believe.

Leading technologies are often ill-defined and under constant construction. Because the techniques needed to stay ahead in the information age will, most likely, not change as quickly as the technologies that sustain us, **the way we learn technology must change.**

Tom Peters writes that, "**We must abandon our old beliefs about learning to just keep up with change**."[58] We must (1) collaborate with one another, (2) draw wisdom from data to be able to (3) articulate what we believe, why we believe it, and (4) be willing to gather new information when it is time to change what we believe.

Constructivist approaches work well when we operate with constantly changing information. If education is to become the soul of the new information systems industry, **we must learn better ways to deal with the unstructured, the undefined, and the unknown**.

Be warned, however. Constructivist approaches don't lend themselves to computer-based training or evaluation where structure is a requisite part of design.

Constructivism is presented here to offer ideas about what to do when facing uncertainty and how to use different approaches in different times. Constructivism works best when technology is new, very complex, and there isn't time or structures set up to build media solutions. It's arduous to test what no one knows.

The constructivist model comes from several contemporary cognitive theorists who began questioning the benefit of cognitive instruction for unknown information and knowledge. They adopted a different way to look at learning and understanding knowledge. Constructivists assert that knowledge is what we make of it. Without minds there would be no knowledge — it's a

[58] Tom Peters (1994). *The Tom Peters seminar: Crazy times call for crazy organizations.* New York: Vintage Books.

function of how we create meaning from our experiences.

The role of instruction in the constructivist view is to show [learners] how to construct knowledge, to promote collaboration with others, to show the multiple perspectives that can be brought to bear on a particular problem, and to arrive at self-chosen positions to which they can commit themselves, while realizing the basis of other views with which they may disagree.

— D. J. Cunningham (1993)[59]

Because of the 'Thriving on Chaos' mentality of the late 1980s and early 1990s, constructivism received increasing attention in the field of training and instructional design.[60] Constructivists emphasize the flexible use of pre-existing knowledge rather than the recall of prepackaged schemes.[61]

As the definitions of words change meaning based on how we understand the context, so too will ideas continually evolve with new use. For this reason, it is critical that constructivist learning (much like cognitive learning) occurs in realistic settings and that the selected learning tasks be relevant to the learner's life experiences. To be successful, meaningful, and lasting, learning must involve actions, understanding concepts, and working knowledge of culture.[62]

For example, a typical constructivist goal wouldn't be to teach novice Local Area Network (LAN) Administrators unique facts about LAN topologies, but to offer them an opportunity to use these facts as they would on the job. By recreating their reality, they learn.

The Internet jumped from 2,300,000 connections in June 1993 to an estimated 23,000,000 in July 1995.[63] While it's easy to think of the Internet as a complex web of computers networked together throughout the world, those connections represent people who now have access to billions of data items on demand.

Cognitive learning environments can effectively transfer basic skills and help learners attain advanced knowledge if the information is well defined and available. Much of what needs to be learned today involves advanced knowledge in ill-structured domains.[64] LANs, for instance, vary wildly. Needs change daily.

Constructivists encourage learners to **construct their own understanding**, based on their reality, **and then validate their new perspectives though social negotiations.** We must talk with others about what we've learned to find out if we're missing something.

Dialogue helps us clarify the subtleties of our thoughts. As we uncover naive theories, we begin to see our activities in a new light, guiding us toward conceptual re-framing and learning.

Content can't be pre-specified. Computer-based training, for instance, wouldn't work as we know it today. Instead, technology indexes information

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[59] D. J. Cunningham (1993, May), Assessing constructions and constructing assessments: A dialogue. *Educational Technology*, *31* (5), pp. 13–17.

[60] Tom Peters (1987). *Thriving on chaos: Handbook for a managment revolution.* New York: Harper and Row.

[61] R. J. Spiro, P. J. Feltovich, M. J. Jacobson, and R. l. Coulson (1991). Cognitive flexibility, constructivism, and hypertext: Random access instruction for advanced knowledge acquisition in ill-structured domains. *Educational Technology, 31* (9), pp. 24–33.

[62] J. S. Brown, A. Collins, and P. Duguid (1989). Situated cognition and the culture of learning. *Educational Research*, *18* (1), pp. 32–42.

[63] MIDS Press Release: Finally, 20 to 30 million users on the Internet (August 25, 1995). Available: http://www.mids.org/mids/press957.html.

[64] D. H. Jonassen (1991). Evaluating constructivist learning. *Educational Technology, 31* (9), pp. 28–33.

and cases, and is accessed when needed from the *learning team.*

For example, constructivism has been widely used in the education of doctors, architects, lawyers, and artisans. Strategies can involve (1) cognitive apprenticeships where experts model and coach a learner toward expert performance; (2) presenting multiple perspectives and using collaborative learning to develop and share alternative views; (3) social negotiation so debate and discussion can take place; (4) using examples as realistic illustrations; and (5) reflective awareness.[65]

Constructivist Methods

- Cognitive apprenticeships
- Presenting various perspectives
- Social negotiation
- Using actual examples
- Reflective awareness

This theory proves challenging, if not impossible, when done individually. This is a model to consider as more people within organizations need to overcome the unknown and consortiums assemble individuals from different organizations facing similar challenges.

Humanism

The information age requires a self-educating workforce capable of peak performance. Our challenge is to stimulate new thinking. Humanism, the theory of individual growth and development, offers us techniques to think in new, creative ways. It is the predominant paradigm of practice within the literature of North American adult and continuing education.

Humanist Instructors

- ✓ Practice andragogic techniques.
- ✓ Draw on life experiences of learners and self.
- ✓ Incorporate learner's unique needs and expectations.
- ✓ Help learners develop critical thinking, judgment, and creativity.
- ✓ Promotes initiative and self-directed learning.

Drawn from the work of humanistic psychologists and the study of andragogy, this theory encompasses teaching and learning assumptions that profoundly influence the field. **Humanist activities facilitate collaborative learning with strong emphasis on learners and instructors negotiating objectives, methods, and evaluative criteria**.[66]

Humanism begins with the theory that learning occurs primarily by reflecting on personal experience. The role of instruction is not to put anything in the mind or repertoire of the learner, but to extract lessons from the learner's insights and experience — like drawing water from a well.[67]

We can gain new insights into previous experiences if we have the opportunity and tools to do so. The role of the instructor is to help learners supplement experiences with new opportunities.

The mediocre teacher tells. The good teacher explains. The superior teacher demonstrates. The great teacher inspires.

— William Arthur Ward

Instruction should ask stimulating questions that help the learner make new connections and uncover what we already know. Real learning is what we discover for ourselves, not something we're told or led to by someone else. This technique took root in the Socratic methods and in Plato's belief that all knowledge is inherent. Later, it developed under Carl Rogers' work with self-

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[65] Peggy A. Ertmer and Timothy J. Newby (1993). Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective. *Performance Improvement Quarterly, 6* (4), pp. 50–72.

[66] Brookfield (1989). p. 203.

[67] Tom Kramlinger and Tom Huberty (1990, December). Behaviorism versus humanism. *Training and Development Journal*, pp. 41–45.

directed therapies.

Additional techniques include (1) inductive discussion, (2) individual or group projects, (3) debriefing sessions, (4) action planning, (5) self-assessment, (6) visualization, and (7) guided reflection.

Humanism stresses that we must feel comfortable with the learning environment and the flow of topics. **The way we feel about a program influences our commitment to it. If we feel secure, respected, esteemed, and empowered, we're likely to make a strong effort. If we feel threatened, anxious, hostile, or demeaned, we're likely to resist.**

Humanistic Methods

1. Inductive discussion
2. Individual or group projects
3. Debriefing sessions
4. Action planning
5. Self-assessment
6. Visualization
7. Guided reflection

Humanism engages learners in intense and personal ways. Programs begin by helping learners identify individual learner-centered objectives drawn from experience. These objectives don't tell us what we should know as defined by someone else. We're responsible for our learning.

Instruction involves learners in the planning stages to ensure topics are relevant and appropriate. Programs rely on self-analysis, team building, and peer learning using various tools and approaches.[68]

Significant learning leads to insights and understanding of ourselves and others. Becoming a better human being is considered a valid learning goal. Rogers believed that anything that can be taught to another person is relatively inconsequential. Rather, desire to learn must come from intrinsic motivation, created by the need for personal growth and fulfillment.

Humanism has little structure, can be used with high conceptual levels, employs self-evaluation, and respects individual differences.

As we move along the behavioral → cognitive → humanist continuum, the focus shifts from teaching to learning. The strategies move from passive transfer of facts and routines to active application of ideas and problems.

While cognitivists, constructivists, and humanists each view learners as active participants, constructivists and humanists regard learners as more than active processors. They believe that learners must elaborate and interpret information.[69]

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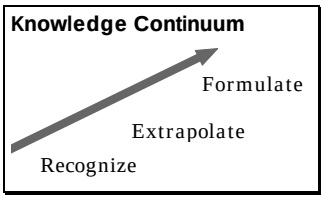
[68] Richard Brostrom (1979). Training styles inventory. In J. E. Jones and J. W. Pfeiffer (Eds.). *1979 Annual handbook for group facilitators*. San Diego, CA: Pfeiffer.

[69] T. M. Duffy and D. Jonassen (1993, May). Constructivism: New implications for instructional technology? *Educational Technology, 31* (5), pp. 13–17.



As we acquire more experience, we progress along a low-to-high knowledge continuum from (1) being able to recognize and apply standard rules, facts and operations (knowing what), to (2) extrapolating from these general rules where problems may occur (knowing how), to (3) developing and testing new understanding and actions when familiar categories and ways of thinking fail (reflection-in-action).[70]

Behaviorism can effectively condition learners to do things in certain ways and familiarize us with the contents of a profession (recognize / know what). Cognitivism proves useful in teaching problem-solving tactics where defined facts and rules apply to unfamiliar situations (extrapolate / know how). Humanism is especially suited to help us deal with whatever problems come our way (formulate / reflection-in-action).

The appropriate instructional approach should be based on the level of cognitive processing required. Tasks requiring low-level processing (such as associations, discriminations, and rote memorization) are most often accomplished with behaviorism. Cognitive strategies fit with subjects that require more advanced processing, classifications, identifying rules, procedural exceptions, and problem solving. Issues that demand high-levels processing are frequently learned best with humanist strategies.

The critical question is not, "Which is the best theory?" but rather, "Which theory is most effective in fostering mastery of specific tasks by individual learners?" What might be most effective when we're novice learners, meeting complex bodies of information for the first time, may not be effective, efficient, or stimulating for learners who are more familiar with the content.

While we can mix strategies, a renewed focus on humanist (and andragogic) practices help us function well when optimal conditions don't exist, when situations are unpredictable, and when we need to think on our feet. **Our rapidly growing, changing, organic environments demand solutions based on inventiveness, improvisation, dialogue, and social negotiation.**[71]

Complete-Loop Learning

Each educational philosophy is goal-based. The goal may be to respond in a certain way (behaviorism), build mental structures (cognitivism), make sense of unknown variables (constructivism), or integrate new experiences with old so growth occurs (humanism).

For programs to help us meet our goals, they must *complete the loop.* Training programs must begin with effective needs analysis and testing so that appropriate systems can be implemented on an individual basis. **We must then measure at what point we start to identify what we accomplish.**

In moving toward a desired destination, it is vital to know where you are now.

— Peter Senge (1990)

[70] Donald A. Schön (1987). *Educating the reflective practitioner.* San Francisco: Jossey-Bass.

[71] Ertmer and Newby (1993).

Testing is not new to education, but evaluation techniques are frequently incompatible with learning goals. While common memorization tests may work in some behavioral programs, other educational approaches require portfolio assessment or self-evaluation.

Questions must be answered about a learning program's purpose before choosing the type of evaluation. With at least six major reasons for evaluating training, direction should define method.

Why Evaluate?

- ✓ Improve instruction.
- ✓ Promote individual growth and self-evaluation.
- ✓ Assess the degree of demonstrable achievement.
- ✓ Diagnose future learning needs.
- ✓ Enhance sense of merit or worth.
- ✓ Identify or clarify desired behaviors.

Reasons include (1) improving the instruction (*formative evaluation*), (2) promoting individual growth and self-evaluation (evaluation by both facilitator and learner), (3) assessing the degree of demonstrable achievement (*summative evaluation* attained by the teacher), (4) diagnosing future learning needs (both facilitator and learner), (5) enhancing sense of merit or worth (learner), (6) identifying or clarifying desired behaviors (teacher).

With so many test types and reasons to evaluate, why are so few used today? From its beginning, the United States has thought of itself as a meritocracy, where people succeed on the strength of talents and abilities to accomplish something. In 1881, the Pendleton Act established that civil service jobs were to be assigned based on merit. It offered something Americans agreed was fair and impartial — a written test.

Army Alpha, an early standardized paper and pencil test, helped the military select World War I troops. This test grew from the belief that intelligence is a single, quantifiable, measurable trait. This test ultimately influenced popular consciousness. Supporters claimed that human abilities can be measured using written multiple-choice questions rather than through evaluation of a person's actual performance. Even though performance was the goal, remembered facts were measured.

The 1920s saw the multiple-choice testing method applied to every conceivable aspect of human nature. The multiple-choice tests' most enduring application has been in measuring educational achievement. Standardized tests went from a fad to an institution. Again, achievement is not measured by doing, but by knowing.

FairTest, one of many groups advocating assessment based on actual performance, estimates that schools in the United States give 100 million standardized tests a year.[72] As the desire for accountability in education grows, so does the demand for standardized testing. Regard for matching approach to method often falls by the wayside. Anyone who has taken a spelling or arithmetic test suspects that what gets tested matters most. We begin to believe that memorizing facts is more important than being able to do something or identify logical conclusions to new problems.

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[72] Erik Strommen (1994, September). Can technology change the test? *Electronic Learning,* pp. 44–53.

This doesn't only apply in school. Who picks up a trade journal without finding an article on evaluation and testing? Industry exams, such as the Certified Novell Engineer (CNE) and the Microsoft Certified Systems Engineer (MCSE), fill the mind like sugar plums for would-be network administrators.

These, too, only demonstrate our test-taking abilities and success memorizing certain facts. **Preoccupation with measuring often ignores authentic learning.**

Should we toss out testing? Probably not. Instead, we should match approach with method. We should **use different types of tests and measure different things.** Let's go back to meritocracy. We must **develop and support programs that measure what we do.**

A testing system based on merit fulfills the human drive for completion. The tests would allow us to know if we're through. While we will never be through learning, our goal-based society hinges on beginnings and ends.

If we can interject some way to quantify what we've learned, we can make a choice to learn more, go on to another topic, or stop. We must complete the loop. Understanding something doesn't mean we've learned it.

As comprehending learners, we (1) *perceive* information through our modalities; (2) *understand* the words and context; (3) *make rel*evant background knowledge active; and (4) allocate *attention* or cognitive resources to concentrate on major content ideas. Then we (5) *evaluate* the meaning (gist) for internal consistency and compatibility with our prior knowledge and common sense; (6) draw and *test* inferences including interpretation, predictions and conclusions; and (7) *monitor* the above to see if comprehension occurred.[73]

Comprehending Learners

- ✓ Perceive information through modalities.
- ✓ Understand words and context.
- ✓ Make relevant background knowledge active.
- ✓ Allocate attention or cognitive resources to concentrate on major content ideas.
- ✓ Evaluate the meaning (gist) for internal consistency and compatibility with our prior knowledge and common sense.
- ✓ Draw and test inferences including interpretation, predictions and conclusions.
- ✓ Monitor the above to see if comprehension occurred.

Most children detest tests. Likewise, exams we take as adults don't always test things we care about beyond the value of passing. By finding ways to test the right things, we can get a snapshot of where we are and where we need to continue. An effective test may not seem like a test at all, but a series of questions that get us thinking and motive us to learn more.

Imagine a day when you sit at your computer with a headset that hooks you into the sound-board of the personal computer. You begin listening to classical music such as Mozart. You start the software program.

Instead of being welcomed by a behavioral objective, "As a result of this you will learn X," you get a smiling face that says, "Hello" and guides you through a brief map helping you discover where you are and where you can journey. The first stop on your tour is a brief, painless test.

What makes the test gratifying is that you write what you think and are assured access to information that fills in the gaps. If you don't know an answer, that's okay. The point of the test is to gauge what you know at the

[73] A. S. Palincsar and A. L. Brown (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1* (2), pp. 117–175.

outset, to actively engage you in thinking about the topic, and to highlight the more crucial aspects of the material.

Your on-line facilitator indicates that you didn't answer question four and asks if you want to go back or skip to a tutorial on question four's topic. You choose to go to the tutorial. (You remember you didn't even understand the fourth question.)

Why not spend some time determining what is worthwhile for us, and then go after that?

— William Ross

You notice words have become icons. You wonder how the program knew you are a visual learner. In the tutorial, you watch a short video and are asked to summarize, with an analogy, what you saw. You select an icon and access more. When you get the gist, you select a menu item labeled, "Let's try that again." You find you understand question four and can answer it.

...Feedback about effectiveness of an individual's behavior has long been recognized as essential for learning and for motivation in performance-oriented organizations.

— D. R. Ilgren, C. D. Fisher, S. M. Taylor (1979)[74]

When you're finished and feel you've learned something valuable you select the map icon again. You can pick any destination areas based on the criteria you set at the beginning. You notice there are other cities over the horizon. You can choose to stay in your city or follow one of the roads. After completing several modules, you take a break never realizing you took twelve tests.

Good test design respects that adults enjoy knowing how we're going to learn and the structure of the content. Asking what we know and what we want to learn (instead of being told what we will learn) helps motivate us. If we enjoy what we're doing, we're more likely to venture into new topics and pay attention when we're there.

We begin with a need or desire to learn (a goal). Assessments (readiness pre-testing and learning styles) ask how we'll process the information most effectively and if we possess the requisite knowledge. If we're ready to learn, we access instruction (content) that can look like a book, video, computer-based training product, or instructor-led class (media options).

Instruction Steps

1. Understand
2. Activate
3. Allocate
4. Evaluate
5. Draw
6. Test
7. Monitor

Sometimes these programs offer pre-work that helps us prepare. In the instruction we need to understand, activate, allocate, evaluate, draw, test, and monitor. If we master the topic (checked through testing) and can use the information, we can access it again and find out if we need to return to the instruction steps. To complete the loop and retain the information, we need to operationalize it and map it back to our everyday actions (reinforcement).

We have a skill, we need a new one, we're ready, we get instruction, we master the materials, we continue. If we aren't ready, we go back and get more prerequisite skills. If we don't master the topics, we go over the material again or manipulate it in a new way.

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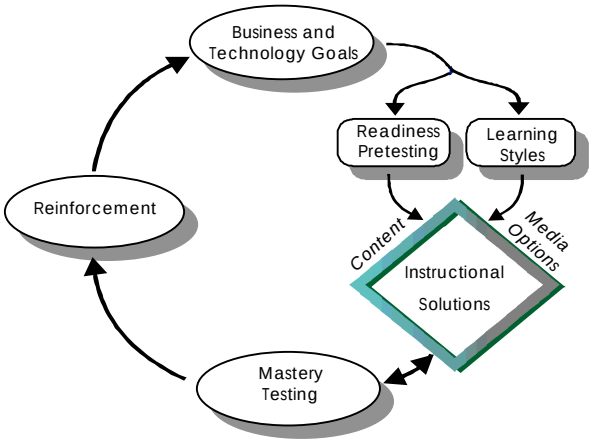
[74] D. R. Ilgren, C. D. Fisher, S. M. Taylor (1979). Consequences of feedback on behavior in organizations. *Journal of Applied Psychology, 64* (4), pp. 349–371.



Well-designed classes should help us complete that loop from skill-needed to skill-acquired. When reading an article or listening to a lecture, we should also use these steps. I**nstructional media works best when we know where we've been (our past) and where we're going (our goal).**

Integrated Media Approach

> The false correlation of learning with training or education is one of the most costly errors in corporate management today.
>
> — John Seely Brown[75]

To achieve comprehensive learning goals, training must consider using every delivery format and medium available. Products and programs must integrate labs, simulations, interactions, and technology to improve the efficiency and effectiveness of the training delivery process. Alone, traditional instructor-led training, video-based instruction, and computer-based training have limits. In combination, they offer real opportunity to evolve.

Instructional media is no more important than the truck that brings your groceries to the grocer has been on your nutritional needs.

— Bill Winn (1992)

Not long ago an article appeared in a large computer magazine announcing that *multimedia* was a technology without a purpose. Though we still haven't realized the potential for computer-based training tools, technology such as multimedia has found at least three areas of application: (1) as a generic information disseminator, (2) as a presentation tool, and (3) as a facilitator of learning.[76]

Electronic Media

- ✓ Disseminate data
- ✓ Display information
- ✓ Facilitate learning

As technologists began worrying about learning, educators began agonizing over technology. To support organic organizations, training-focused groups will have to apply the appropriate tools for the new and changing tasks.

In 1994 Lakewood Publication's Training Directors' Forum reported that the top three learning challenges identified by senior training managers were (1) coping with fast-paced technological change and the huge learning

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[75] Lewis J. Perelman (1994, June). Kanban to kanbrain. *Forbes ASAP,* p. 85.

[76] Tom Palaskas, Instructional Designer, University of Sydney. (Personal correspondence January 12–22, 1995.)

requirements technology poses; (2) developing technological solutions to training needs; and (3) managing change in all its many aspects.[77]

Distance learning, such as programmed instruction, multimedia, computer-based training, and other ideas with big bandwagon potential, means different things to different people. You need to think about what it means to you, and you need to find out what it means to the people who are trying to advise you...or sell you something. As with CBT and multimedia, it's very easy to get the technological cart in front of the design and development horse.

— Dave Ferguson (1994)

Using computer-based training in education poses several advantages. (1) It helps learners focus on the *need-to-know*, and provides the opportunity to jump to the *like-to-know*. (2) Electronic media allows organization to be evident. Learning is enhanced when material is organized and that organization is apparent to the learner. (3) Media can adapt and complement learning styles.

Computer-based training

- ✓ Helps learners focus on the 'need-to-know,' and provides the opportunity to jump to the 'like-to-know.'
- ✓ Makes organization evident.
- ✓ Adapts and complements learning styles.

As technology improves, educational opportunities increase. Inexpensive computer technology and convenient mass storage offers learners boundless discoveries and challenges. Learners interested in a particular topic can now scan an electronic encyclopedia, view a video on a subject, and look at related topics by selecting an icon or menu item.

Interactive learning stations can combine the advantages of reference materials, still pictures, motion pictures, television, and computer-based training in one easy-to-access place all the time. With connections to the Internet, these stations can also transcend geographic barriers.

Offering integrated media, in accessible formats, allows learners opportunities where and when needed. *Appendix C* contains a general summary of specific media to familiarize you with the possibilities.

Conclusions and Directions

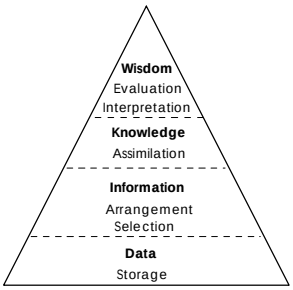
After surveying and reflecting upon adult learning, we find we've come full circle. **The more knowledge we gain about learning styles and techniques, the more there is left to discover.** The process never ends. Our understanding will grow as long as we continue to experiment and seek insight. That's what makes the journey so fascinating.

G. Steven Tuthill, in *Knowledge Engineering*, asserts that to move forward in the information age we must learn to do more than store and process data. We must analyze information and branch meaningful messages from 'noise.' Moreover, once we can separate, we need to become good synthesizers and develop true knowledge.

[77] The remaining learning challenges in the top 15 were (4) making training and organizational learning more business-focused, market-aware and aligned with corporate strategy and objectives. (5) Meeting training needs with shrinking or limited resources. (6) Meeting new management development needs, training for new ways to lead. (7) Delivering training to multiple sites quickly or simultaneously. (8) Measuring training transfer and return on investment. (9) Meeting training needs as time allotted for training shrinks. (10) Creating team-based operations. (11) Creating fast, more effective sales and new product training. (12) Creating training for a diverse and/or multicultural workforce. (13) Delivering on-the-job, just-in-time training. (14) Delivering shorter, more cost-effective training. (15) Training for internal and external customer service. Training Directors' Forum Survey 1994.

This knowledge is then compared to other collections of knowledge to gain insight and guide decisions. Only then is wisdom born.[78]

If we want to move from an era based on data processing to one of wisdom building, we will need to work under a variety of conditions and think (and learn) independently of programmed response. We must move away from behavioral strategies and begin to develop cognitive strategies to compete and grow.



Developed by 3M IT Education Services, based on G. Steven Tuthill's Data Hierarchy

The words inscribed over the Temple at Delphi read "Know Thyself." This is the greatest challenge in life. By determining our own unique learning styles, accepting our differences, and even using them to help ourselves and others learn more effectively, we find the wisest approach to learning. When it comes to learning, one size does not fit all.

If the goal of training is to know more, the goal of education is to assume we know less; to challenge old assumptions and to become less sure of preconceived notions. Only as we question assumptions do we open ourselves to gain deeper insight.[79]

After reading this paper, we may have more questions than answers. Outstanding. **This paper acts as a springboard to propel you toward a journey of self-discovery and a life of rewarding learning experiences.**

Share these ideas with coworkers, friends, and family members. Be creative about ways to apply the approaches. The information can be useful for people of all ages, in every walk of life. This is only the beginning.

The opportunities to learn more effectively are incredible. Though the list of opportunities was long, you should find that the knowledge you desired to learn, the items you circled at the very beginning, are now within your grasp. Go back to those circled items. Have you learned the things you circled? If not, review those areas again and return here.

If you learned the things that you circled, congratulations! You now hold in your head the key to learning technology and anything else that comes your way. It is now time to progress to the next stage. It's time to use the information you learned.

Take this information and go, do, be. Enjoy.

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[78] G. Steven Tuthill (1989). *Knowledge engineering*. Blue Ridge Summit, PA: TAB Books. pp. 5–7.

[79] Rita Shelley. No one is more than me. *Adult Learning*, p 26.

Appendix A — Learning Styles Assessment

Read the word(s) in the left column and circle the description that best expresses how you usually handle each situation.[80]

When you	Visual	Auditory	Kinesthetic and Tactile
Spell	Do you try to see the word?	Sound out the word, or use a phonetic approach?	Write the word down to find if it feels right?
Talk	Talk sparingly, but dislike listening for too long? Do you favor words such as *see*, *picture*, and *imagine*?	Enjoy listening, but are impatient to talk? Use words such as *hear*, *tune*, and *think*?	Gesture and use expressive movements? Use words such as *feel*, *touch*, and *hold*?
Visualize	Do you see vivid, detailed pictures?	Think in sounds?	Have few images, all involving movement?
Concentrate	Do you become distracted by untidiness or movement?	Become distracted by sounds or noises?	Become distracted by activity around you?
Meet someone again	Do you forget names, but remember faces? Remember where you met?	Forget faces, but remember names? Remember what you talked about?	Remember best what you did together?
Contact people on business	Do you prefer direct, face-to-face, personal meetings?	Prefer the telephone?	Talk with them while walking or participating in an activity?
Relax	Do you prefer to watch TV, a play, or movie?	Prefer to listen to the radio, music, or read?	Prefer to play games or work with your hands?
Try to interpret someone's mood	Do you primarily look at facial expressions?	Listen to tone of voice?	Watch body movement?
Read	Do you like descriptive scenes? Pause to imagine the action?	Enjoy dialogue and conversation, or hear the characters talk?	Prefer action stories or are not a keen reader?
Do something new at work	Do you like to see demonstrations, diagrams, slides or posters?	Prefer verbal instructions or talking about it with someone else?	Prefer to jump right in and try it?
Put something together	Do you look at the directions and the picture?	Like to talk with someone or find yourself talking out loud as you work?	Ignore the directions and figure it out as you go along?
Need help with a computer application	Do you seek out pictures or diagrams?	Call the help-desk, ask a neighbor, or growl at the computer?	Keep trying to do it or try it on another computer?
Teach someone	Do you prefer to show them?	Prefer to tell them?	Do it for them and let them see how it's done or ask them to try it?

Many responses probably fell in one column, with several in a second column, and very few in the third. The column that represents your actions best is your primary processing style. The second most is your auxiliary style. Though this test is not very technical or complicated, most adults know how they respond to situations.

By spending time thinking about reactions, you can identify how you prefer to process information. This assessment looks at your modality preferences. In the *Learning Styles* section and *Glossary* of this paper, we look at other types of inventories, too. For the sake of reading paper-based information, modality assessments offer insight into how you can adjust your approach to meet your needs. The *Lifelong Learning* section covers techniques that work well with various styles.

[80] Adapted from Colin Rose (1987). *Accelerated learning*. New York: Dell. pp. 147–149.

Appendix B — Glossary (and Buzz-words)

Learning the vocabulary associated with a field can help you understand a topic and let you place the context for both written and verbal discussions. The following list is not complete, but addresses the common terms and concepts referred to in the learning business.

Accelerated Learning Methodology developed by Bulgarian Georgi Lozanov called Suggestopedia; *SuperLearning* or Accelerated Learning in North America. In broad terms, it is a research-based technology and an innovative philosophy that uses learners' holistic natural talents to provide them the highest probability of maximizing their learning, retention, and performance. An accelerated learning system creates a stress-free, positive, joyful, psychologically and physically healthy environment that enhances self-esteem and focuses on the needs of the learner.[81]

Active Learning Individuals learn or change most easily when they actively engage in the learning process. *Active* implies hands-on and minds-on involvement in learning. Unfortunately, education and training are often group-based and passive experiences rather than individualized and active.

Adventure Education Education or learning that involves some element of perceived risk. Hands-on education that challenges one's limits (challenge or ropes courses, climbing walls, wilderness training, for example) and is a part of *Experiential Education*.

Affective Style See *Personality Patterns*.

Andragogy (and-rè-go´jê) Initially defined as, "the art and science of helping adults learn," the term currently offers an alternative to *pedagogy* and refers to *learner-focused education* for people of all ages. The andragogic model asks that five issues be considered and addressed in formal learning. They include:

(1) Letting learners know why something is important to learn

(2) Showing learners how to direct themselves through information

(3) Relating the topic to the learner's experiences.

(4) People will not learn until ready and motivated to learn.

(5) Often this requires helping them overcome inhibitions, behaviors, and beliefs about learning.

Behavioral Objectives Sometimes referred to as performance, instructional, learner, or terminal objectives, these descriptive statements inform learners what will be measured. This type of objective reflects the belief that at a pre-determined, externally controlled time, a learner will know or be able to do something new. The three components of an objective are:

(1) The identified behavior

(2) The specific conditions

(3) The evaluative criteria.

Behaviorism Education theory asserting that behavior can change as a result of extrinsic

[81] Clement (1992). p. 529.

motivations such as incentives, rewards, and punishments. Behavioral psychology advocates the process of influencing behavior through the systematic adjustments of stimulus-response reinforcements. Much of the research in the field is based on B. F. Skinner's work in the early 1930s. He observed that by controlling the environment of mice in a lab he could train them to behave consistently. From this research came theories designed to train humans. Behavioral instruction hinges on the use of observable, measurable, and controllable objectives. An educator determines what objectives the learner should achieve. These objectives are met when the learner responds in a certain way.

Body Clocks As learning styles differ, so do our internal body-clocks. These clocks effect the way we think and feel during the day (and night). The problem is that most people are not aware of the common or unique features of their own clock. Several studies, including the work of Carol Orlock[82] and Keith Miller, et al.,[83] show that memory, for instance, works more efficiently during certain hours. Few people have high-memory functions all day. Generally, short-term memory works best in the morning. Hands-on work is usually accomplished more effectively in the middle of the day. As afternoon closes, we often want to sit and reflect on what we've done. If we move beyond these broad categories and identify our body-clock cycles, we can learn and adapt more effectively.

Case-based Reasoning The technique for solving new problems by adapting solutions used to solve old problems. Each case can contain a description of the situation, ways the situation differed from similar situations, and how the system reacted to the situation.[84]

Cell Assemblies Activity in a group of nerve cells. A group of cell assemblies is called a *phase sequence.*

Certification A voluntary program that in some organized way *evaluates* and measures an individual's qualifications to perform a specialized function. While some certifications convey no authority or privilege, others, such as those for Certified Public Accountants (CPA) and teachers, are required to hold certain jobs. Certification exists today in many professions and trades.

Chunking A way to make the most of working memories by organizing materials into logical information groupings.

Cognitive Style See *Information Processing.*

Cognitivism Education theory stating that information is more likely acquired, retained, and retrieved for future use if it's learner-constructed, relevant, and built upon prior knowledge. Cognitive psychology concerns the study of individuals' perceptual processes, problem-solving abilities, and reasoning

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[82] Carol Orlock (1995). *Know your body clock.* New York: Birch Lane Press.

[83] Keith Miller, Brian C. Syles, and David G. Wastell. Times of day retrieval from long-term memory. *British Journal of Psychology, 71*, pp. 407–414.

[84] Janet L. Kolodner and Menachem Y. Jona (1991, June). *Case-based reasoning: An overview*. Technical Report 15. Evanston, IL: Northwestern University's The Institute for the Learning Sciences.

abilities. Cognitive education programs are often organized in *chunks*, and have built-in or learner-generated memory devices to help learners retain and use the information in the future. Cognitive models give learners control by introducing conceptual frameworks and by relying on both *experiential* and d*iscovery learning.*

Computer-Based Training (CBT) Interactive instructional experience between a computer and a learner in which the computer provides the majority of the stimulus and the learner responds, resulting in progress toward increased skills or knowledge.[85] For a more complete definition, see Appendix C.

Computer Disk Interactive (CD-I) See Appendix C.

Computer Managed Learning See Appendix C.

Constructivism Educational theory stating that learners do more than absorb and store information. We make tentative interpretations of experience and go on to elaborate and test what we determine. Our mental structures are formed, elaborated, and tested until we establish a satisfactory structure. Constructivist theory says that people are active and don't only respond to stimuli as *behaviorism* suggests. We engage, grapple, and seek to make sense of things.

Contextual-based Learning We recall what we've learned most easily when we learn in the environment where we repeat the work. When we learn at our desks or on-site, we reinforce our new-found knowledge through environmental cues. The more similar the context the better. Also see *Scripts.*

Criterion Reference Tests Evaluation instrument that measures performance based upon instructional *objectives.*

Delivery Systems Devices or programs that present instructional content.

Dialogue and Discussion Dialogue literally defines the words between us. *Dia* means 'between,' *logos* means 'words.' Hence, *dia + logue* = the words between us.[86] The dialogue principle holds that adults have enough life experience to be in dialogue with one another, about any subject, and will learn new knowledge, attitudes, or skills best about that life experience.[87] *Discussion* stems from the same words as percussion and concussion, and means one-way sound.

Discovery Learning Learning occurs when learners don't receive subject matter in its final form, but rather when we organize it into categories. We then use these categories in processes such as perception, decision making, and conceptualizing. Jerome Bruner, a leading discovery theorist, advocates an inductive approach to learning. Instruction should build from specific categories to generic codes that help learners form coding systems.[88]

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[85] Gloria Gery (1987). *Making CBT happen.* Cambridge, MA: Ziff Institute.

[86] Vella (1994). p. 3.

[87] Malcolm Knowles (1970). *The modern practice of adult education.* New York: Association Press.

[88] S. S. Dubin and M. Okun (1973). Implications of learning theories for adult instruction. *Adult Education, 24* (1), pp. 1–15.

Distance Learning See Appendix C.

Drill and Practice An educational method that consists of repeating the instructional content and related exercises over time until mastery occurs.

Double-loop Learning A process by which we challenge and focus on our own underlying processes, goals, norms, and practices. This contrasts with the more traditional single-loop learning where we engage in detecting and correcting errors or problems. In double-loop learning one doesn't ask, "How can I improve or fix X?" but rather, "Why am I doing X at all?"

Electronic Performance Support Systems (EPSS) See Appendix C.

Evaluation A way to determine what one has learned. Evaluation can take many forms including memorization tests, portfolio assessment, and self-reflection. There are at least six major reasons for evaluating training, each requiring a different type of evaluation. They include:

(1) Improve the instruction (*formative evaluation*)

(2) Promote individual growth and self-evaluation (evaluation by both facilitator and learner)

(3) Assess the degree of demonstrated achievement (*summative evaluation* attained by the teacher)

(4) Diagnose future learning needs (of both facilitator and learner)

(5) Enhance one's sense of merit or worth (learner)

(6) Identify or clarify desired behaviors (teacher).

Evaluation Hierarchy Donald Kirkpatrick identified the evaluation model most widely recognized today in corporate training organizations. The *Kirkpatrick Model* addresses the four fundamental behavior changes that occur as a result of training.

Level One is how participants *feel* about training (reaction). This level is often measured with attitude questionnaires.

Level Two determines if people *memorized* the material. This is often accomplished with pre- and post-testing.

Level Three answers the question, "Do people *use the information* on the job?" This level addresses transference of new skills to the jobs (behavior change). This is often accomplished by observation.

Level Four measures the *training effectiveness*, "What result has the training achieved?" This broad category is concerned with the impact of the program on the wider community (results).[89]

Experiential Education Any learning based on experiencing: doing, exploring, and even living.

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[89] Donald L. Kirkpatrick (1967). Evaluation of training. In R. Craig and L. Bittel (Eds.), *Training and development handbook*. New York: McGraw-Hill. Also referenced in Stephen D. Brookfield (1986). *Understanding and facilitating adult learning*. San Francisco: Jossey-Bass.

Facilitated Self Study See *Self Study* in Appendix C.

Formative Evaluation Collecting data and information to improve instruction or learning activity effectiveness.

Guided Design A method of developing skills with practical decision-making exercises and group projects.

Help Systems See Appendix C.

Humanism Humanist learning theories are concerned with the human potential for growth. Humanism holds that perceptions are centered in experience. Humanists believe that people are inherently good and that behavior is the result of choice. They also believe that adults are open to change and lifelong learning. Humanistic education focuses on the individual learner rather than on the content. Programs rely on self-analysis, team building, and peer learning using various tools and approaches.

Hypertext and Hypermedia See Appendix C.

Individualized Learning The educational approach maintaining that we learn on our own and through self-direction. We direct our learning experiences by choosing the sequence, level of performance, and pace.

Information Processing Type of learning styles' assessment that distinguishes between the way we sense, think, solve problems, and remember information. Each of us has a preferred, consistent, distinct way of perceiving, organizing, and retaining information. Also called *cognitive style.*

Instructor-led Training (ILT) See Appendix C.

Interactive CD-ROM See *Computer Disk Interactive (CD-I)* in Appendix C.

Job-aids Any tool that allows a learner to get information quickly when he or she needs it to complete a task. Often these are paper-based and posted on the wall in plain sight or in a small reference notebook. At other times, huge procedure manuals are considered job-aids because they allow users to get information as needed.

Just-in-Time Learning Instructional activities delivered at the location where the learner does the job or needs the information. Just-in-time learning offers an alternative to traditional training and can replace warehousing knowledge in classrooms and libraries. It doesn't carry the price of travel, the risk of being away from the office during an unforeseen crisis, nor the risk of being without the tools to review the information when back on the job. Likewise, we can work at the best times of day and we can tailor the instruction to meet our agendas.

Kanbrain A name coined to define *just-in-time learning* programs. At the heart of Kanbrain are electronic performance support systems, facilitated self-study, and interactive distance education.[90] The name comes from *Kanban*, the historically Japanese just-in-time delivery process that made dramatic changes

[90] Perelman (1994). pp. 85–95.

in worldwide supply, manufacturing, distribution, and retailing. Nicknamed after the kanban order cards on Toyota production lines, just-in-time supply decisions are based directly on demand.

Kinesthetic Relates to kinesthesia, the sensation of position and movement. It defines processing that occurs while engaged in physical movement and from tension in parts of the body as perceived through nerve-end organs in muscles, tendons, and joints. A kinesthetic learner may walk or move around an object to absorb meaning from it.

Knowledge Repository Also called *computer-based references*, knowledge repositories refer to on-line (look up) reference systems that house information necessary to perform job functions. They can contain books, software, and a company's intellectual property. See also *Electronic Performance Support Systems* in *Appendix C.*

Learner-centered Education Education focused on the learner's needs, preferences, and interests, not those of the instructor, organization, or subject matter.

Learning The act, process, or experience of gaining knowledge or skills. Physiologically, learning is the formation of cell assemblies and phase sequences. Children's learning builds these assemblies and sequences. Adults spend more time making new arrangements than forming new sequences. Experience and background allow us to learn new concepts.

Learning Contracts Mutually agreed upon learning objectives and learning methods between instructor and learner that usually contains a time component.

Learning Organization An organization that continually expands capabilities by facilitating its members' learning and continuously transforming itself to meet strategic goals. Individual learning does not guarantee organizational learning, but without it, no organizational learning occurs.

Learning Style Composite *cognitive*, *affective*, and *physiological* factors serve as relatively stable indicators of how a learner perceives, interacts with, and responds to the learning environment. Included in this definition are *perceptual modalities*, *information processing* styles, and *personality patterns*.

Learning Time The faster we try to learn, the harder it is to grasp concepts and ideas.[91] We may be able to memorize something quickly, but that doesn't mean we've learned it. Most people store new information in short-term memory. Without reflecting, we may never move the information into long-term memory and put it into a scheme where we can access it again. When we're new to a topic, we need time to process and reflect. When we're familiar with a concept, we need less time to process, but just as much time to reflect. Reflection takes as long because we have more experiences to integrate, assemble, and sequence throughout the day.

Levels of Competence Unconscious incompetence, Conscious incompetence, Unconscious competence, Conscious competence, Competence.

Lifelong Learning A belief that adults learn throughout life. See *Personal Mastery*.

[91] U.S. Department of Education (1994). Prisoners of time.

Memory The capacity to store, retrieve, and act on knowledge.

Mental Models Internalized assumptions, generalizations, or even pictures and images that influence our understanding of work and how we take action. They are so integrated into our lives that we may not even be consciously aware of our mental models or the effects they have on our behavior.[92]

Metacognition The ability to think about thinking, to be consciously aware of ourselves as problem solvers, and to monitor and control our mental processing. Metacognitive skills all involve awareness and control over learning and problem solving. We can learn these skills by working through one topic and then apply them when trying to learn a second topic. The keys include:

- Our awareness of the difference between understanding and memorizing material and which mental strategies to use in each case
- Our ability to recognize which parts of study are difficult and where to start and how much time to spend
- Our awareness of the need to take problems and examples from the materials, order them, and then try to solve them
- Knowing when we don't understand, so we can seek help from an expert
- Knowing when the expert's explanation solves our immediate learning problem.[93]

Multimedia See Appendix C.

Neo-behaviorism Educational theory stating that neurological processes intervene between stimuli and responses (behaviorism). Learners must have relevant sensory experiences to succeed at scholastic tasks and must capitalize on previous experiences when attempting to learn new topics. When learners lack the requisite background, the first job of the instructor is to have the individual engage in experiences that will provide the necessary prerequisite information or skills. Donald O. Hebb, the father of neo-behaviorism, also indicated that instructors should analyze a skill or lesson into its component parts and teach each one separately. The underlying tenet of the theory is that mediation (activity between input of a stimulus and output of response) consists of activity in a group of nerve cells known as a *cell assembly*. Whenever there is activity in a group of cell assemblies (called *phase sequences*) mediation occurs.[94]

Objectives See *Behavioral Objectives*.

On-line Education See Appendix C.

Pedagogy (pèd-e-go´jê) Literally means the art and science of educating children, pedagogy is often used as a synonym for teaching. Pedagogy is from the Greek word *paid*, meaning 'child,' and *agogus* meaning 'leader of.' More accurately, pedagogy embodies teacher-focused education. In the pedagogic model, teachers

[92] Senge (1990).

[93] Brown, et al. (1983).

[94] Donald O. Hebb (1949). *The organization of behavior*. New York: Wiley.

assume responsibility for making decisions about what will be learned, how it will be learned, and when it will be learned. Teachers direct learning.

Perceptual Modality Learning style that refers to the primary way our bodies take in and perceive information; auditory, visual, kinesthetic, and tactile.

Performance Support See *Electronic Performance Support Systems* in Appendix C.

Performance Technology Technologies designed to enhance human performance and capabilities in the workplace.[95] Also referred to as *human performance technology*, it is a systematic process of integrating practices from a vast breadth of fields such as instructional technology, organizational development, motivation, feedback, human factors, and employee selection.[96]

Personal Mastery The ability to consistently realize the results that matter most deeply to us. We do so by committing to our own lifelong learning. Personal mastery also includes continually clarifying and deepening our personal vision, focusing our energies, developing patience, and seeing reality objectively.[97]

Personality Patterns In the first half of the 1900s, Carl Jung established a field identifying distinct personality patterns. Many theorists have since broken these patterns into categories attempting to make them easier to understand. The most widely used and researched is the Myers Briggs Type Indicator (MBTI). Another popular program in corporate America is the DiSC assessment, offered by Carlson Learning. While the various programs use very different terminology to name the patterns, many rely on the same terms to describe characteristics in each pattern. No single style indicator ensures that a learner's needs will be met. However, systems that address the learners in each category are more likely to feel comfortable to various learners. Likewise, educators and instructional designers who recognize their own styles can make sure their instruction meets needs beyond their individual comfort. The more styles addressed, the more likely instruction is to offer something for each type of learner.

Phase Sequences A group of *cell assemblies.*

Psychological Style See *Perceptual Modality.*

Psychometrics The measurement of human achievement and capabilities.

Regulated Learning Directed or paced learning facilitated by an instructor.

Scripts Studies show we learn to do new things by creating *scripts* containing how to sequentially act in any given situation.[98] With scripts we direct our lives. For instance, when we get ready to work on a computer, one script subconsciously has us follow a set of ordered procedures. We may adjust our chair, power up, then enter a series of commands, and so forth. We've

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[95] Harold D. Stolovitch and Erica J. Keeps (Eds.) (1992). *Handbook of human performance technology.* San Francisco: Jossey-Bass. ISBN 1-55542-385-X.

[96] Allison Rossett quoting Cathleen Smith Hutchinson (1990). A performance technology process model. *Performance and Instruction, 29* (3), 1-5.

[97] Senge (1990). p. 7.

[98] Shank (1994).

learned the steps to accomplish the task — we have a Start your PC script.

We recall scripts most easily when we build them in the environment where we repeat the work. The more similar the situation the better.

Training programs allow us to build the new scripts necessary to reduce the confused feeling we have the first time we try something. Active learning helps us build scripts and develop the *muscle memory* that allows us to act again. Building scripts in the environment where we will repeat the work helps us integrate and transfer our new-found learning.

Self-directed Learning Learning initiated and directed by the learner. Either for leisure learning or as a result of being informed that we may need additional knowledge for a job, or school. More and more training departments are developing courses that employees go through at their own pace.

Self Study See *Facilitated Self Study* in Appendix C.

Summative Evaluation A process designed to verify the overall effectiveness of the instructional design. A summative evaluation determines whether a program will be continued, concluded, or replicated.

Systems Thinking A conceptual framework, body of knowledge, and tools developed over the past fifty years to make the patterns in a system clearer to those who use them and to help us see how to change the systems effectively.[99]

Tactile Sensation received through sense of touch. Also referred to as *haptic*.

Teacher-centered Education Learning theory stating that teachers assume responsibility for making decisions about what will be learned, how it will be learned, and when it will be learned. Teachers direct learning.

Team Learning Begins with dialogue and the capacity of team members to suspend assumptions and enter into a state of thinking together.

Teleconferencing See Appendix C.

Virtual Reality See Appendix C.

Whitepaper A research or position paper designed to provide a reader with information on an organization, product, program, or methodology. It is believed the name stems from busy executives who wanted to learn from clear, concise terms and documents. "Give me simple *white paper* defining what you stand for, instead of a brochure with your marketing hype and jargon."

[99] Senge (1990). p. 7.

Appendix C — Instructional Media

Even though the terms to define instructional media have not found a common voice, the following serves as a place to start. Spend some time reflecting on how you would benefit from each medium and think about how each can be adapted to meet the learning needs of your organization.

Computer-Based Training (CBT)

Computer-based training is the encompassing term defining educational products developed and delivered using computer technology. Computer-based training is one of many terms, most with overlapping meanings, related to educational programs designed to serve as teaching tools. Others include *computer-based instruction (CBI), computer-assisted learning (CAL), computer-assisted training (CAT), computer-aided instruction (CAI),* and *computer-managed instruction (CMI).* The term CBT (computer-based training) is used primarily in the United States, while CAL (computer-assisted learning) is often used in Europe and the United Kingdom.

Over the past two decades, CBT's bright promise all but disappeared. Developers rarely took advantage of a computer's capability to assess progress and branch accordingly. Products were uninteresting and too limiting for learners to enjoy and continue using.[100]

Linear CBT refers to those computer-based training programs that lack branching. The learner is forced along a straight path without options to branch based on her or his needs or responses. The uninteresting CBTs were dubbed *electronic page turners* because programs were little more than on-line books where one screen lead to another in a linear fashion.

Fueled by technical advances and ever-increasing demands for training, CBT programs have become excellent aids for presenting factual material and for allowing learners to pace their speed. Programs should actively involve learners every step of the way and be flexible enough to branch to appropriate segments, depending on the assessment of learner progress. The best CBT programs keep the materials interesting and inject humor as appropriate. (If learners wanted to stay passive, they would opt for video courses or other less interactive media.)

CBT can be used alone or supplement traditional classroom delivery and print-based material. It can provide tests, practice, and exploration. Facts, concepts, and principles can be introduced, and then various practice activities and tests can use the computer as the delivery medium.

Computer Disk Interactive (CD-I)

In 1991 Philips, with Sony (and others) formed a technical standard for the interactive use of CD-ROM material. This was a European initiative and has led to the development of interactive entertainment and educational compact disk products. Typically, standard televisions are coupled to a special CD-I/interactive player. The user interacts with a remote control unit similar to one for a standard television. The interaction is limited to *page turning* and basic branching because there is no keyboard interface.

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[100] P. L. Olympia (1994, March). Developing hot CAI courses. *Database Management Systems (DBMS),* pp. 92–93.

Once hailed, "The next great medium," CD-I plans seem to be dwindling. At this time, it is unclear if CD-I will return or fade away.

Computer Managed Learning (CML)

Also called Computer Managed Instruction (CMI), CML refers to using computers to help manage the learning process. The computer is used as a managerial, clerical, statistical, and administrative tool for tasks such as enrollment, learner statistics and learner profiles, test marking, score analysis, audio-visual resource management, and general training record keeping.[101]

Distance Learning

In its broadest definition, distance learning is what happens whenever the instructor and the learner are not in the same place at the same time. This covers everything from correspondence courses to two-way multi-site video conferences and classes delivered over the Internet.

It is worth noting that distance learning means different things in different countries. For instance, in the United States, distance learning usually parallels traditional study, differing only in the type of delivery media used, and almost always containing some face-to-face interaction with learners. In Europe and the United Kingdom, distance learning usually refers to individualized study. In Australia, the definition lies somewhere in-between.

Electronic Performance Support Systems (EPSS/PSS)

Electronic Performance Support Systems are high-tech job-aids that combine tutorials, reference libraries, and computer-based training in a single system accessible to workers as-needed. Learners can ask for advice, look up information, and take a class any time, and all at practically the same time. With EPSS we can learn without leaving our desks or work site. Learning and supports are provided when needed and at the level needed.[102] As companies begin organizing their information in retrievable data forms, EPSS will become more widely used.

Help Systems

The most common type of just-in-time education comes from electronic job-aids called *help files.* These *hypertext* files are often built directly into computer programs to aid learners as they use the application. New users, and those wanting to try something for the first time, have grown to rely on these menu-driven files offering additional information, instructions, or tips. More and more, application developers are putting additional tutorial data into help systems rather than relying on manuals or paper-based documentation.

Hypertext and Hypermedia

Hypertext refers to non-sequential writing.

Hypermedia defines presentational media that performs in branching and other multidimensional ways.[103] This branching allows the learner to jump (or link) not only from one set of words to another, but from one media to another, offering music, pictures, video, and sounds in the ultimate non-linear environment. With the aid of the Internet, these links can come from different places in the world.

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[101] Palaskas (1995).

[102] Carolyn Ladd (1993, August) Should performance support be in your computer? *Training and Development*. pp. 23–25.

[103] Ted Nelson coined the terms Hypertext and Hypermedia in 1965. He built on theses idea in the 1973 book *Computer lib and dream machines* (last published by Microsoft Press, 1987).

Instructor-led Training (ILT)

Instructor-led training is the most widely used education format. With this method, learners:

- Access equipment not available in their work settings.
- Get real-time resource suggestions and industry perspective.
- Have an opportunity to network and learn from others' experiences.
- Work with instructors who challenge learners' pre-existing beliefs and can modify a message until learners build their own *mental models*.

In addition, perceptual modality studies indicate that some people need someone to talk with for instruction to be meaningful. Others have pre-defined ideas about learning and are unwilling and unmotivated to try learning on their own.

Because an instructor (who often has expertise in the class topic) guides the training, courses can disseminate a large amount of information with less pre-course development time than technically driven media.

Multimedia

Multimedia applications combine traditional digital computer information, such as text and data, with traditional analog information such as pictures, audio, video, and animation. Multimedia applications are being used today in stand-alone and networked environments to support a variety of functions. Training and education are the most popular application areas for multimedia today.

On-line Education

In increasing numbers, companies and universities are using the Internet and other on-line mediums to facilitate instruction.

- Facilitators can pose questions to on-line learners and discuss topics through electronic mail (e-mail).
- Instruction designers can develop a series of self-directed exercises for on-line learners to work through at their own pace.
- Individuals can have interactive sessions with experts one-on-one, or in a small distribution group, as well as during special scheduled events that might work more like traditional classes.

The implications and opportunities for on-line education are only limited by the technology available today and our imaginations.

Performance Support System (PSS)

See *Electronic Performance Support System*.

Self Study and Facilitated Self Study

Self Study is instruction developed for an individual to work through independently.

Facilitated Self Study is instruction developed for an individual to work through independently, but with the support, interaction, and guidance of a facilitator or instructor. Some facilitated self-study programs offer the services of a guru on the other end of a telephone line or an e-mail address that allows the learner and expert to converse.

Teleconferencing

Generally, teleconferencing defines people gathered in different locations by means of telecommunications equipment. Historically, teleconferencing has

required an assembly of people in a high-tech room who pay very expensive rates for satellite hookup. Today, however, vendors are offering desktop video conference packages at affordable prices enabling users to conference with other users right from their desks.

With the visual signal moving across supported protocols (including telephone lines and the Internet) these applications offer an interactive and collaborative atmosphere where learners can work real-time with other teleconference participants. The application of teleconferencing in training will increase as the tools become more widely available and accessible.

Video-Based Training Video tapes are one of the older instructional media products still used today. Though not intrinsically interactive, video offers an opportunity for learners to hear and see experts talk about or do things unavailable on-site. When supplemented with case studies, discussions, and hands-on work, they can be very effective.

Virtual Reality Using digital and full motion video, software, and specially designed hardware, virtual reality can help learners master new skills. It isolates learners from natural audio and visual sensory inputs (with the use of goggles and headsets) and instead offering a synthetic representation of reality (virtual reality). In this virtual place, learners can try new things without fear of failure or danger. Applications currently focus on entertainment, but future training applications with virtual reality will provide an outstanding vehicle for simulations and labs.

Appendix D — Resources

The following books, articles, and Internet sites provide additional information on the topics discussed in this paper.

Books and Articles

Educational Psychology

Applying cognitive learning theory to adult learning. Daniele D. Flannery (ed.). New Directions for Adult and Continuing Education, No. 59, Fall 1993.

"Behaviorism, cognitivism, constructivism: Comparing critical features from an instructional design perspective." Peggy A. Ertmer and Timothy J. Newby. *Performance Improvement Quarterly, 6* (4), pp. 50-72.

Constructionism. Idit Harel and Seymour Papert (Eds.). Norwood, NJ: Ablex, 1991. ISBN 0-89391-785-0.

"Killing the fatted calf: Skinner recanted behaviorism. Why can't education?" David Thornburg. *Electronic Learning.* September 1994.

"The mind's journey from novice to expert." John T. Bruer. *American Educator.* Summer 1993. 7-15, 38-47.

The mind's new science: A history of the cognitive revolution. Howard Gardner. New York: Basic Books, 1985. ISBN 0-465-04635-5.

Punished by rewards: The trouble with gold stars, incentive plans, A's, praise, and other bribes. Alfie Kohn. Boston: Houghton Mifflin, 1993. ISBN 0-395-65028-3.

Educational Technology

The computer training handbook, 2nd ed. Elliott Masie. Minneapolis, MN: Lakewood Books, 1995.

Electronic performance support systems. Gloria Gery. Cambridge, MA: Ziff Institute, 1991. ISBN 0-9617968-1-2.

"Kanban to kanbrain." Lewis J. Perelman. *Forbes ASAP.* June 1994. 85-95.

Making CBT happen. Gloria Gery. Cambridge, MA: Ziff Institute, 1987. ISBN 0-9617968-0-4.

Active and Experiential Learning

Educating the reflective practitioner. Donald A. Schön. San Francisco: Jossey-Bass, 1987. ISBN 1-55542-025-7.

Experience and education. John Dewey. Collier Macmillan, 1938.

Experiential learning: Experience as the source of learning and development. David Kolb. Englewood Cliffs, NJ: Prentice-Hall, 1984. ISBN 0-13295-261-0.

Inspiring active learning: A handbook for teachers. Merrill Harmin. Alexandria, VA: ASCD, 1994. ISBN 0-87120-228-X.

The theory of experiential education, 2nd ed. Richard Kraft and Mitchell Sakofs (Eds.). Boulder, CO: Association of Experiential Education, 1994.

What we learn when we learn by doing. Roger C. Schank. Technical Report 60. Northwestern University: Institute for the Learning Science, October 1994.

Knowledge Age

The fifth discipline: The art and practice of the learning organization. Peter M. Senge. New York: Doubleday, 1990. ISBN 0-385-26094-6.

The fifth discipline fieldbook. P. Senge, C. Roberts, R. Ross, B. Smith, and A. Kleiner. New York: Doubleday, 1994. ISBN 0-385-47256-0.

The Learning Edge. Calhoun W. Wick and Lu Stanton León. New York: McGraw Hill, 1993. ISBN 0-07-070082-6.

Knowledge engineering. G. Steven Tuthill. Blue Ridge Summit, PA: TAB Books, 1989. ISBN 0-83069-297-5.

Knowledge for action. Chris Argyris. San Francisco: Jossey-Bass, 1993. ISBN 1-55542-519-4.

Leadership and the new science. Margaret Wheatley. San Francisco: Berrett-Koehler, 1994. ISBN 1-881052-44-3.

Life and work in a technological society. Sandra Kerka. ERIC Digest No. 147. Columbus, OH: ERIC Clearinghouse on Adult, Career, and Vocational Education, OSU, 1993. (ED 368 892).

The monster under the bed: How business is mastering the opportunity of knowledge for profit Stan Davis and Jim Botkin. Simon and Schuster, 1994. ISBN 0-671-87107-2.

Thriving on chaos. Tom Peters. New York: Harper and Row, 1987. ISBN 006-097184-3.

Learning Styles

Accelerated learning. Colin Rose. New York: Dell, 1985. ISBN 0-440-500044-3.

The art of the possible: A compassionate approach to understand the way people think, learn, and communicate. Donna Markova. Emeryville, CA: Conari Press, 1991. ISBN 0-943233-12-7.

Frames of mind: The theory of multiple intelligences, 2nd ed. Howard Gardner. New York: Basic Books, 1993. ISBN 0-465-0251-0.

Quantum Learning. Bobbi DePorter with Mike Hernacki. New York: Dell, 1992. ISBN 0-440-50427-9.

SuperLearning 2000. Lynn Schroeder and Sheila Ostrander. New York: Delacorte Press, 1994. ISBN 0-38531-274-1.

Lifelong Learning

The adult learner: A neglected species, 4th ed. Malcolm Knowles. Houston, TX: Gulf Publishing, 1990. ISBN 0-87201-074-0.

Adults as learners. K. Patricia Cross. San Francisco: Jossey-Bass, 1981. ISBN 0-87589-491-7.

Becoming a master student, 6th ed. David B. Ellis. Rapid City, SD: College Survival, 1991. ISBN 0-942456-10-6.

Learning in adulthood. Sharan B. Merriam and Rosemary S. Caffarella. San Francisco: Jossey-Bass, 1991. ISBN 1-55542-312-4

Learning to learn across the life span. Robert M. Smith and Associates. San Francisco: Jossey-Bass, 1990. ISBN 1-55542-279-9.

More learning in less time, 4th ed. Norma B. Kahn. Berkeley, CA: Ten Speed Press, 1992. ISBN 0-89815-499-5.

Transformative dimensions of adult learning. Jack Mezirow. San Francisco: Jossey-Bass, 1991. ISBN 1-55542-339-6.

Understanding and facilitating adult learning. Stephen D. Brookfield. San Francisco: Jossey-Bass, 1986. ISBN 1-55542-355-8.

Neuro-Physiology

The brain book. Peter Russell. New York: Plume, 1979. ISBN 0-452-26723-4.

Know your body clock. Carol Orlock. New York: Birch Lane Press, 1995. ISBN 0-8065-1703-4.

Mindmapping. Joyce Wycoff. New York: Berkley Books, 1991. ISBN 0-425-12780X.

The owner's manual for the brain. Pierce J. Howard, Ph.D. Austin, TX: Leornian Press, 1994. ISBN 0-9636389-0-4.

Reference

The ASTD technical and skills training handbook. Leslie Kelley. McGraw-Hill, 1995. ISBN 0-07-033899-X.

The corporate trainer's quick reference. Geoffrey Moss. Homewood, IL: Business One Irwin, 1992. ISBN 1-55623-905-X.

Handbook of human performance technology. Harold D. Slalovitch and Erica J. Keeps (Eds.). San Francisco, CA: Jossey-Bass, 1992. ISBN 1-55542-385-X.

How to read a book: The classic guide to intelligent reading. Mortimer J. Adler and Charles Van Doren. New York: Simon and Schuster, 1972. ISBN 0-671-21280-X.

Trainer's dictionary: HRD terms, abbreviations, and acronyms. Angus Reynolds. Amherst, MA: HRD Press, 1993. ISBN 0-87425-219-9.

Internet Resources

Following are the locations of Discussion Lists, Newsgroups, and World Wide Web sites that address learning.

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To: listserv@address.xxx
From: Yourname
Subject: <Blank>

sub Nameoflist Yourname
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Discussion Lists

To subscribe to these lists use the standard listserv format.

AEDNET Adult Education Network	listserv@pulsar.acast.nova.edu
COMPUTER-TRAINING Computer training digest from the Masie Institute and ISU	listserv@bilbo.isu.edu
DEOS-L International forum for distance learning	listserv@psuvm.psu.edu
DISTED On-line Chronicle of Distance Education and Communication	listserv@pulsar.acast.nova.edu
EDSTYLE Learning styles theory and research	listserv@sjuvm.stjohns.edu
EDTECH Educational technology list	listserv@msu.edu
ITTE Information technology and teacher education	listserv@deakin.oz.au
LEARNING-ORG Forum on learning organization concepts and shared experiences	majordomo@world.std.com
MEDIA-L Media in education	listserv@bingvmb.cc.binghamton.edu
MMEDIA-L Multimedia in education and training	listserv@vm.cnuce.cnr.it
NETTRAIN Training about and over networks	listserv@ubvm.cc.buffalo.edu
OHIOMM Multimedia development forum	listserv@miamiu.acs.muohio.edu
TRDEV-L Training and Development discussions	listserv@psuvm.psu.edu

Newsgroups

alt.education.distance	Learning over nets
alt.psychology.nlp	Neurolinguistic programming
alt.psychology.personality	Personality taxonomy such as Myers-Briggs
bit.listserv.edtech	Educational technology (mirrors discussion list EDTECH)
misc.education.adult	Adult education discussion
misc.education.multimedia	Multimedia's role in education discussion

World Wide Web

A longer listing of on-line resources for people interested in learning can be retrieved from:

- http://www.tcm.com/trdev/faq/
- ftp://psych.psy.uq.oz.au/lists/arlist/trdfaq.txt
- or by sending the e-mail message "get trdfaq.txt" (without the quotes) to arlist-request@psy.uq.oz.au

Wave Technologies International, Inc.

Established in 1988 to address the growing market demand for training in sophisticated information technologies, Wave has emerged as the premier independent technology training company in the United States. With a growing geographical presence throughout the world, Wave currently serves over 25,000 industry professionals each year.

Making the learning process adaptive and accessible is key to Wave's training methodology. Wave understands the complexities of the information technology industry, acknowledges the differences in adult learning styles, and develops its training portfolio to meet the collective needs of the individuals and companies it serves. Wave completes the loop in the training process to identify subject matter competency, needs awareness, learning style, and a performance benchmark. With a broad range of courses covering local area networking (LAN) and wide area networking (WAN), advanced operating systems, telecommunications, and client server systems technologies, Wave is at the forefront of a constantly changing market.

As an independent training company, Wave addresses the challenges of integrating products from multiple vendors within a single network environment. Wave provides clear, objective, product-specific information for practical application within a versatile and affordable delivery framework.

Wave offers publications, videos, multimedia products, instructor-led training, and software. Product lines grow as new educational technologies evolve. Products can be adapted to meet customer requirements and individual company technologies.

Publications	Video Products	Multimedia Products	Instructor-led Training	Software
Course manuals	Technical tips videos	Computer-aided instruction	Hands-on classes	Pre-course and learning-style assessment
Study guides	Train-the-trainer videos	Adaptive learning programs	Train-the-trainer	Certification preparation
Whitepapers	Self-paced (tutorial) video	Real-time simulations	Workshops	Help files
Seminar notes	Interactive video instruction	Interactive references	Vendor seminars	Course development databases
Self-paced (tutorial) books	Full-length video courses	Information and knowledge-bases	Technology briefings	Knowledge repositories
Industry textbooks	Promotional videos	Learning engines	Facilitated self-study	
			Help-desk support	
			On-line courses	

Wave constantly expands its geographical reach and product lines to serve the needs of information system professionals throughout the world. With headquarters in St. Louis, the company currently provides training programs from major cities throughout the United States, United Kingdom, Australia, and South Africa. Wave directly markets its courses and published products to management information systems professionals, systems integrators, value-added resellers, and others with systems management responsibilities throughout the world.