

3000 YEARS OF EDUCATIONAL TECHNOLOGY

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ABSTRACT

This paper contains a very broad history and survey of teaching. Important teachers or leaders are used as examples. The application Psychology, History, and Experience are discussed. This discussion includes a model or "ideal" teaching and aids such as computers. A summary includes suggestions as to how the ideas presented can be used to make learning experiences more effective and valuable. Specific suggestions are made that live teachers are part of appropriate educational technology. The teachers should use lectures, illustrations, "visual aids", and various techniques to make presentations more interesting and memorable. New electronic equipment such as video and computer hardware and software should be used to present repetitive instruction more effectively than live professors. Class members must be appropriately involved in the learning process. In general, effective teaching approaches EXPERIENCE as closely as possible.

Introduction

There have been great or effective teachers throughout history, and surely before recorded history. It is difficult to imagine people having the skills of hunting, gathering, and growing things without being taught the necessary survival skills. In one sense, that has not changed to this day. The necessary survival skills have changed a great deal. This leads us to the issue of the proper use of modern technology.

Among the earliest records is the book of Genesis in the Old Testament by an unknown author. Krsna's lectures to Prince Arjuna are a primary source of Hindu theology and philosophy. (Bhaktivedevanta, 1972) Moses was apparently a good teacher, using lectures and demonstrations. The parting of the Red Sea was very effective, according to The Old Testament and recent accounts. "Aristotle (b. 384 BC), more than any one thinker, determined the orientation and the content of Western intellectual history." (EBCD) He taught by lecture and writings. Socrates (b. BC 470) "wrote nothing" during his life and is known primarily by what others wrote about

him. We gather from these writings that he was a great questioner. (EBCD) The value of questions in teaching and learning was verified by Psychologists centuries later.

In the Book of Mormon, a King Benjamin called his subjects together for a lecture that apparently lasted for hours. (Mosiah, 1-4) The lecture seemed to be well received then and is highly regarded by many after 2100 years.

Jesus Christ is highly regarded as a great teacher. He used demonstrations such as raising the dead, according to the several writers. There is no record that he "published" anything in his lifetime. The records indicate that he taught in words and ideas that the people could understand well. Some of these reported words are still teaching millions of people.

Mohammed and Gautama, the Buddha presented lectures that have influenced many millions of people. They seem to have written nothing personally, but were widely reported.

George Washington, Abraham Lincoln, John Kennedy, and Martin Luther King, Jr. are widely regarded as important teachers. Kennedy and King

worked in the age of radio and television, as well as being able to write and publish books and documents.

Other modern teachers who have affected the world, or parts of it, include Chief Sitting Bull, Geronimo, Vladimir Lenin, Adolf Hitler, and Alexander Kerensky. They show that many effective teachers were not teaching what much of the world would call truth. The contest of ideas of Kerensky and Lenin determined much of the 20th Century and the lives of billions of people. It seems clear that speaking and writing have been important parts of teaching technology for millennia.

Methods

Comments have already been made about the value of lectures. It is the simplest and "least powerful" method. It is also the most adaptive. It can be changed to suit each time, learner, and situation. It was powerful enough for Hitler to talk to millions of people simultaneously by radio. There are pictures of him lecturing to thousands at public events. We now get lectures by television from President Clinton and many, many others

Demonstrations have always been effective. Psychologists have explanations for this effectiveness. It is very effective to part the Red Sea or raise the dead. But we must generally settle for much less dramatic demonstrations. It is very important to SHOW what we want to teach. There are many kinds of demonstrations.

Questions may be as effective now as they were 2500 years ago in directing learners' attention to things or matters that help students to better understand. If a class has been given the assignment to find out about United Airlines' financial position, a reasonable question is: How profitable is UAL? Answers are likely to range from wild guesses and evasions to well-thought-out correct answers.

If the question is directed toward the group, eager and well-prepared members will quickly answer and take the heat from the rest of the group. Such answers also identify the members who are well prepared.

If the question is directed toward a specific member, the preparedness will show up quickly. If the answer is evasive, probing is appropriate.

Such probing will generally reveal whether the member did not understand the assignment, did not understand the material, or has some other reason for the inability to answer.

Non answers or wrong answers present the professor with an opportunity to destroy the member and demonstrate the professor's superior knowledge. BUT IT ALSO PRESENTS AN OPPORTUNITY TO DIRECT THE ATTENTION OF THE GROUP AND INDIVIDUALS TO SPECIFIC ISSUES OR SUBJECTS. The writer has seen class members needlessly abused and driven from the class and even the program by such attacks.

The most likely outcome is that group members will prepare for meetings more carefully and more completely. Another outcome is that the professor gains a much clearer idea of what the members need to know and do to succeed in the class and program.

The recommended way to handle answers is to try to make ANY answer valuable. A beginning is to compliment members for good answers. Another approach is to find some merit, somewhere, in the answer. Such responses include: "Many people think that your answer is the right answer." Another is:

"That is a good answer, but we can improve on it.

Fred, can you see how to make the explanation more complete?" Still another is: "It is very good that you brought out that point of view." etc.

THE OBJECTIVE OF ALL OF THIS IS TO FIND OUT WHERE THE GROUP MEMBERS ARE AND TO INVOLVE THEM IN MOVING FORWARD TO BETTER UNDERSTANDING. It is good to use the quick members to help the slower ones (keeping them all involved)

One of the most successful classes the writer saw in decades was a Business Law class at Antioch College. The faculty had developed the following method: Students were given the assignment to read the legal principles involved and then to read specific cases. When the class met, each member was asked to explain one of the assigned cases. Two points were awarded for correctly explaining the law. Two more points were awarded for correctly explaining the facts of the case. One point was awarded for the student's decision of the case.

As anyone familiar with law knows, THE ONLY CASES THAT GO TO COURT ARE THOSE WITH TWO GOOD ANSWERS. The members of the class conveniently chose different decisions.

Each student was sure that his/her answer was better than the opposite side. The meetings were very productive and a lot of fun. The class members learned a lot of law and had some fine debates. Their textbooks were generally worn out by the end of the term.

Psychologists would say that such sessions got the members highly involved in the learning and that the discussion, issues, and meetings were very memorable and vivid. Professor Theodore Beckman used this method primarily in his doctoral seminars in Marketing at Ohio State. Such issues as the Northwest Airlines snowstorm in Detroit are opportunities for Embry-Riddle classes.

The Psychological Environment of Learning

Dr Rudolf Pintner quotes Edward L. Thorndike's 3 major laws of learning as:

1. Readiness. When a bond (learning) is ready to act, to act gives satisfaction, and not to act gives annoyance.
2. The more a given response is connected with a certain situation, the more likely it is to be made to that situation.

3. Satisfying results strengthen and discomfort weakens the bond between situation and response.

Thorndike formulated five minor or secondary laws which amplify and extend his major laws of learning:

1. the law of multiple response to the same external situations (consider alternative possibilities).
 2. the law of attitude, set, or disposition (how the learner feels about the situation).
 3. the law of partial activity (the learner selects responses to situations).
 4. the law of assimilation or analogy (responses to one situation may also be valuable in other situations).
 5. the law of associative shifting (which operates much like 4 above).
- (Pintner, 1970)

The Encyclopedia Britannica CD1998 articles about Perception contain a great deal of recent and early research results. The educational Psychology books neglected PERCEPTION. In the classroom (of any sort), perception is one of the most important factors in learning. A survey of the articles produced the following valuable suggestions:

1. "Perception or perceiving refers to the process whereby sensory stimulation is translated into organized experiences."
2. "Perception is contextual". Vivid contrasts are more obvious and memorable.
3. "The discovery thesis is reflected in Eleanor Gibson's view that perceptual learning is a process of discovering how to transform previously overlooked potentials of sensory stimulation into effective information. Enrichment theories depict perceptual learning as enriching sensory experience with specific association and with rules for its interpretation that derive from past experience."
4. "Concurrent visual stimulation may modify one's acuity in detecting auditory stimuli... The brain does not function as a collection of entirely independent channels."
5. "...It is evident that there are clear differences in perceptual functioning among individuals, among classes of individuals, and within the same individual from one occasion to another".
6. "The burden of much research is to show that the type of physical environment people

construct for themselves or choose to inhabit influence their style of perceiving."

Objectives

After an explanation of Taylor's Scientific Management, B. R. Bugelski wrote:

The assumption of "the better way" requires that one face any current human operation with the attitude that, while it may be reasonably satisfactory now, sooner or later the task will change, methods will be improved, and the improvements might be better attempted deliberately (as they are in industry through Research and Development departments) than left to chance. (Bugelski, 1964)

It is proposed here that Embry-Riddle Aeronautical University welcome any better way to provide learning opportunities if such a way is shown to be effective. It is also essential to find the best ways to help the learner to deal with the flood of information that seems to be increasing at an increasing rate. It

is our job to help learners to sort out the valuable new knowledge from the mass of opinion, speculation, and rumor that abounds.

Our Faculty Manual states that we should be making our classes "Challenging. Demanding. Worthwhile." It says that Embry-Riddle wants students to gain more than a factual understanding of Aviation/Space. We also want students to build their skills in speaking before groups, professional writing, and using software applications. (6)

The Manual also contains a paper presented at the Fourth Annual College Career Education Faculty Symposium On Teaching Effectiveness, that states:

Accelerated learning tends to:

- emphasize wholeness
- welcome diversity
- exalt the individual
- nurture creativity
- be BOTH/AND
- be purposefully eclectic
- be collaborative
- liberate
- release human energy
- be dynamic & flexible
- be geodesic & mutual
- be multipathed
- feel natural
- be multisensory
- be joyful
- be a state of mind

It also states that we are to:

1. Create a classroom setting that is colorful, comfortable, and naturally stimulating.
2. Create an environment to get the fun and (success) back into learning rather than the seriousness.
3. Create an environment which helps students to eliminate or reduce any fears, stress, or learning barriers they might have.
4. Create an environment which is collaborative and mutually supportive rather than driven by traditional parent-child assumptions about instruction. (ibid.)

Our Graduate Catalog states that:

It is the purpose of Embry-Riddle to provide a comprehensive education that prepares graduates for productive careers and responsible citizenship to support the needs of aviation, aerospace engineering, and related fields." (p. 7)

Now the question must be asked; How does all of the

above apply to a classroom?
There are many answers.
These are formidable
objectives and challenges.

Our Classrooms

WE WANT TO MAKE THE
EXPERIENCE VALUABLE. In
order to do that, the
experience must be
remembered and contain
valuable and accurate
information. We professors
must learn what is useful,
valuable, and accurate, and
then help members of the
class to see and understand
these things.

THEY ARE ALL DIFFERENT
ALL OF THE TIME. One
presentation, to a group,
is a risky method of
"teaching". Everyone in
the room will have a
slightly (or greatly)
different understanding of
what is said (or shown,
etc.).

THEY RECEIVE
"GESTALTS", or collections
of information. Straight
lecture is generally the
least effective
presentation. It involves
only one sense, hearing.
If the professor moves
around, the effect is more
vivid and/or memorable.
Pictures, diagrams, etc.
convey more information
more vividly. If the
pictures move or change,
they are more "important"

and memorable. If touch,
smell, and taste are used,
THE EXPERIENCE INVOLVES ALL
OF THE SENSES AND IS MOST
VIVID AND MEMORABLE.

THEY ADD OUR
PRESENTATIONS TO WHAT THEY
ALREADY KNOW OR BELIEVE.
And each one of them is
unique.

"Socratic" Teaching

Asking the right
questions correctly can be
very valuable in class
meetings and individual
interviews or counseling.
From a psychological point
of view, the question
directs the attention of
the listener, away from
whatever current thinking,
toward a specific idea or
subject. This subject
tends to be pulled out of
the total environment of
the listener, for special
attention.

Such a question serves
several purposes. One
purpose is to isolate or
highlight a particular
idea. A second purpose is
an assessment of their
readiness to consider and
answer such a question.
Such questions will often
reveal that one or more
members of the class have
not done reading
assignments or are
otherwise not prepared with
correct answers. Such
questions serve as a

warning as to what the professor expects from the class and what the professor thinks is important.

Sometimes our "classroom" is watching a videotape. Sometimes it is operating a computer program. Sometimes it is a field trip to an important site related to the subject.

The author has been and continues to be a strong proponent of "experiential learning" wherever possible.

The Ideal Lesson

The ideal "lesson" will involve as many senses as possible. It will add to whatever each person already knows or believes. It will stand out vividly from the environment or life of each class member.

Straight lecture is the least vivid and memorable thing to do. BUT IT IS ALSO THE MOST VERSATILE. It, alone, can include the news of the day or events that are unique and important to the group AT THE TIME OF THE MEETING.

Illustrated lectures are more interesting and vivid. But they generally require "props" and planning. A NOTABLE EXCEPTION TO THIS RULE IS THE GROUP MEMBERS THEMSELVES. This is the

great value of student participation and participation. An occasional student testimony or story is often more valuable than anything the professor can say or do.

Illustrations that move or are properly colored are generally more vivid and memorable than black and white and motionless. If stationary black and white stimuli are a sharp contrast to the busy and colorful environment, they may be very memorable.

THE MOST VIVID AND MEMORABLE LESSON IS

EXPERIENCE. It may be in a classroom where a person or group discovery is made. It may be in a factory where airplanes or missiles are made. It may be in a military unit where a decision is made and orders are issued.

An example is teaching International Business. One approach is to talk about it. A better presentation is pictures, "artifacts" and other evidence. Moving and colored pictures and items are better. BUT THE BEST WAY TO LEARN ABOUT ANOTHER NATION OR CULTURE IS TO GO THERE AND SEE IT, FEEL IT, SMELL IT, TASTE IT, AND LISTEN TO IT.

Classroom (or other activity) participation is one method of involving group members in life, discussion, or discovery. This is actually EXPERIENCING what is happening. The great value of INTERNSHIPS AND FIELD TRIPS IS THAT THEY ARE EXPERIENCE.

We all know that international travel, wars, internships, and other experience can be very expensive and difficult to arrange. So we must usually settle for simpler and less expensive models or simulations of reality.

Hardware

The most versatile piece of "hardware" is the professor. But the typical classroom situation becomes less vivid and memorable as the hours (or even minutes) go on. Chalk boards are a welcome relief. Demonstrations and physical models have important places in learning. This traditional progression of instructional techniques always includes colored slides, then motion pictures, and then ACTUAL EXPERIENCE, which has been explained.

But there is a relatively new part of learning that needs more attention now. IT CAN BE

CALLED ELECTRONIC INSTRUCTION. It began as radio and then various kinds of recordings. Then came television and an entire new world of experience. Then the tube became colored and tapes were possible. These media were generally sequentially accessible, meaning that everyone was "forced" to go through the same process, often at the same rate.

For decades, computers were only for engineers and some "nerds" who were skilled in the use of computers. BUT NOW WE HAVE A GENERATION THAT IS GROWING UP WITH COMPUTERS AS SOME OF US GREW UP WITH RADIO, TELEPHONES, AIRPLANES, AND BOOKS. COMPUTERS HAVE ALWAYS BEEN A PART OF THIS GENERATION'S LIVES.

Computer Learning

Some of us recall "programmed learning", which began as a Pavlovian machine that gave us questions with a few canned answers. The early versions were less exciting than a pinball machine and only marginally more informative.

Now we have computer programs that are much more exciting than a pinball machine and which can be more informative than professors often are. The

early attempts by computer technicians produced much excitement along with some learning. A current example is enclosed of 1998 computer teaching/learning by Encyclopedia Britannica.

WHEN VIDEO TECHNOLOGY IS COMBINED WITH COMPUTER TECHNOLOGY, ELECTRONIC LEARNING CAN BECOME AN APPROXIMATION OR GOOD MODEL OF REALITY AND EXPERIENCE.

So far, we do not have the smell or taste. The new generation transfers much of the proprioceptive (touch) stimuli

From the keyboard or joystick to "reality".

WHEN THE INTERNET IS ADDED TO THE ABOVE, WE HAVE SOME OF THE MOST POWERFUL INSTRUCTIONAL CAPABILITIES THAT HAVE EVER EXISTED.

Both of these media permit random access to information. The good part of random access is that well-qualified learners may cover any given subject much more quickly. The bad news is that random access permits students to skip over introductory or basic information and not understand what they are reading or doing. An example of internet capabilities is added to this paper.

SUMMARY

1. Information that is unique to the specific

meeting should generally be presented in a lecture.

2. The lecture will be more effective if it is illustrated with a chalk board or other writing.

3. Personal interaction, such as counseling or explaining ideas to specific groups or individuals should generally be done in person, by a professor, including telephone, e-mail, or other communication.

4. When the same material is presented by the same person in the same way to each class, it should be recorded in print or electronic media and should be as interesting as possible.

5. Recorded messages can be reviewed by class members at will.

6. Nearly all electronic communication is more effective if it is colored and moves.

7. One of the great advantages of computers is that they can interact with the learner.

8. Computers can interact through local software or by internet.

9. Videotape information is generally sequentially stored. (and accessed)

10. Much computer software is stored as randomly accessible.

11. Individual and class business should be

conducted live or electronically with persons individually or in groups.

12. Repetitive information should be presented mechanically, on tape, disks, or other electronic media, books, or analog (photos, etc.) records.

13. Learners should interact with information sources electronically and by physical (books, people, "artifacts", etc.) means.

14. Learners must practice evaluating and comparing information sources.

15. The internet should supplement "physical" information sources, and they should supplement the internet.

16. THE MOST EFFICIENT LEARNING IS TO USE MACHINES TO DO WHAT THEY DO BEST, USE PROFESSORS FOR WHAT NOTHING ELSE CAN DO; AND USE STUDENTS FOR INTERACTION, EXAMPLES, AND THEIR OWN SPEAKING, WRITING, AND USE OF SOFTWARE.

REFERENCES

- Bhaktivedanta, A.C., Bhagavad-gita As It Is, New York: Collier Books., 1972, Chapter 1.
- Book of Mormon, The Salt Lake City, Utah: The Church of Jesus Christ of Latter-Day Saints, 1991,
- Bugelski, B. R., The Psychology of Learning Applied to Teaching: New York The Bobbs Merrill Company, Inc. 1964, p.8.
- Embry-Riddle Aeronautical University, F.E. Warren AFB Resident Center Faculty Manual p. A-2.
- Encyclopedia Britannica CD1998, Aristotle, Socrates, Kerensky, and other articles.
- Holy Bible, Authorized King James Version: Cleveland and New York, The World Publishing Company, no date.
- Pintner, Rudolph, (ed.) Educational Psychology, New York: Barnes and Noble Books, 1870 6th ed. p.102.

BIBLIOGRAPHY

Beiles, Nancy, "CommonPlaces' CollegeBytes.com Site Aims to Be Students' Web Destination", The Wall Street Journal, May 10, 1999.

Burt, E. A. , The Teachings of the Compassionate Buddha, New York: Mentor Books, 1955.

Dawood, N. J., The Koran, Harmondsworth, Middlesex, England: Penguin Books, Ltd., 1986

Lenin, V. I. State and Revolution, New York: International Publishers, 1968.

Thompson, J. A. K., The Ethics of Aristotle, Baltimore: Penguin Books, 1966.

Wysocki, Bernard, Jr., "Corporate Caveat: Dell or Be Delled", The Wall Street Journal, May 10, 1999.

VITA

Kent L. Foutz has been engaged professionally in teaching and training since 1950, when he was in a Frigidaire distributor's sales promotion department. He was engaged in this kind of work much of the time until 1960, when he began teaching at Antioch College in Ohio. His college-level teaching career has included 17 institutions and a wide variety of settings, including "continuing education", community colleges, a "proprietary school", and graduate programs in Business and Marketing.