1926

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY

College of Career Education

Third Annual Symposium

on

Teaching Effectiveness

Presented by University Faculty
November 8, 1995
Daytona Beach, Florida

Table of Contents

INTRODUCTION

The faculty of the Extended Campus of Embry Riddle Aeronautical University are pleased to present these papers from the College's Third Annual Symposium on Teaching Effectiveness. This symposium is conducted annually to share information and stimulate interest in research about teaching more effectively. The papers presented herein are the product of faculty members from throughout the extensive network of teaching sites in the United States and Europe.

This symposium and the next several will focus on various aspects of the utilization of technology to improve the effectiveness of the learning process. We hope that this will give the faculty the opportunity to explore, experiment with, and evaluate different technologies and methods for their employment in improving all aspects of the learning process.

The development of the personal computer coupled with high speed data transmission has opened vast new opportunities for improving the effectiveness of the learning process. This combination has been widely touted as the greatest boon to education since the invention of the printing press. Yet we find ourselves, after some five centuries of experience with print technology, still looking for optimum methods for presenting printed material for a particular learning situation.

While emerging technology presents wonderful new opportunities, the technology alone will not necessarily improve education. Like past new technologies such as moving pictures, radio and television, which at the time of their emergence were to revolutionize teaching and learning, the technology of today requires skillful employment to be most effectively used and live up to its promise. Employment for the "gee whiz" factor soon becomes hollow and lacking of true content. What is required is experimentation and exploration by skilled educational professionals, coupled with accurate assessment measures to see if we are accomplishing what we desire to accomplish. It is also necessary to share knowledge of that which works well and that which works less well with each other.

A torque wrench is a wonderful tool and well suited for tightening nuts to a given tightness. It can also drive nails, but less well than a hammer which is also much more economical to obtain and maintain. The same may be true for computer based educational technology. There may be roles for which it is superbly suited and will greatly aid the learning process, and there may be other roles for which it will work, but less well than other means. Much of the new technology available to the educator is expensive and takes some skill to use. The pace with which new technology is emerging makes it difficult and expensive for educators to keep up with what's currently available and the mechanics of how to use it. Consideration for when, where, and in what situation and combination to optimally employ that technology for most effective learning easily fails to take primacy. What we wish to encourage is a concerted effort to seek answers to the questions of what, when, how, and in what combinations to employ the tools of teaching for effective learning.

S. Earl Wheeler, Ph.D.
Chairman, Faculty Development Committee

LINKING TEACHING AND LEARNING STYLES THROUGH MEDIA DELIVERY SYSTEMS DESIGNED WITH KOLB'S LEARNING MODEL

by

Steven N. Ulosevich, Ed.D.
Adjunct Assistant Professor
Embry-Riddle Aeronautical University
College of Career Education, Randolph AFB Resident Center, Texas

ABSTRACT

The major premise of this paper proposes that current and emerging applications of electronic and computer technologies can assist educators in teaching students both task-related and critical thinking skills. The purpose of this paper is to: (1) review selected learning style and teaching style literature, (2) propose a framework that can serve as an organizing structure for choosing an appropriate multimedia delivery system, and (3) briefly outline implications for researchers, educators and students.

INTRODUCTION

Since instructors often determine teaching methods on the basis of their teaching preferences, it appears that they may not be designing their learning environments compatible with the learning styles of their students (Gail & Calvert, 1984). It has been suggested that educators make greater use of active modes of teaching, and that they require students to take greater responsibility for their learning (DoE, 1984). Similarly, educational institutions have been encouraged to consider changed student expectations and the impact of electronics and technology on education as a way of addressing student needs more fully (Osterman, 1982).

The major premise of this paper is that current and emerging applications of electronic and computer technologies can assist educators in teaching students both *task-related* (i.e., how to) and *critical thinking* (i.e., conceptualizing) skills. The purpose of the paper is to propose a framework that can serve as an organizing structure for choosing an appropriate multimedia delivery system. The term "multimedia" is defined as the combination or integration of electronic, video, audio, and/or computer technologies. A delivery system is created when one or more of these media is adapted to an educational setting to accomplish a learning objective.

Specifically, this paper is developed along three lines. First, selected learning style and teaching method literature are briefly reviewed. Second, a framework is presented. Finally, implications for students, educators, and researchers are provided.

LEARNING PROCESS VARIABLES

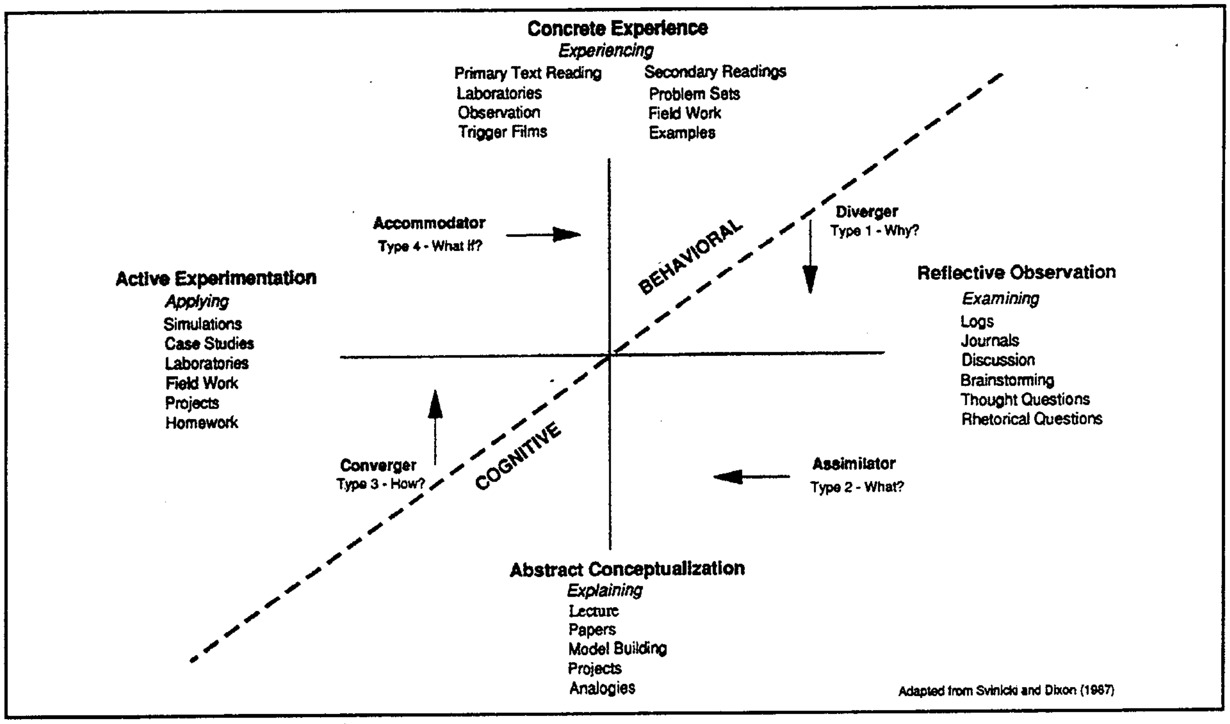
Educators have increasingly recognized that while educational objectives are necessarily a key consideration in course and curriculum design, the learning process itself is a function of the learning environment, teaching method, and student learning style (Frontczak, 1990b). A number of studies have measured student learning styles in terms of psychological, cognitive, sociological, and communicative constructs (Eison, 1979; Kolb, 1976); while Clark offers specific instructional methods as motivators for students who differ in their study styles (Clark, 1984). Rumelhart and Norman have proposed that learning objectives be divided into procedural (i.e., practical) or declarative (i.e., conceptual) categories, and have highlighted various student learning and study styles, methods of instruction, and educational objectives as components of the learning process (Rumelhart & Norman, 1981).

Although scholars have not reached consensus on a single learning style model, Kolb's Learning Style Inventory (LSI) (Kolb, 1976) has been widely utilized with college students and "adult learners"

(Dorsey & Pierson, 1984), defined as students whose education has been interrupted by family or career commitments. Although the LSI is not without its critics (Certo & Lamb, 1980; Hunsaker, 1980), it has received support as a functional framework when implementing an experiential approach to classroom teaching (Svinicki & Dixon, 1987). Conceptually, Frontczak has provided educators with teaching methods considered appropriate for Kolb's student learning styles (Frontczak, 1990b).

The LSI provides a two-dimensional view (see Figure 1, Page 5) of the learning process. Concrete experience and abstract conceptualization are graphed on the vertical axis, while reflective observation and active experimentation are depicted on the horizontal axis. In this model, an individual acquires knowledge by means of a series of steps moving through the bipolar dimensions. Moreover, McCarthy has identified the types of questions likely to be asked by individuals in each of the four quadrants: Type One learners ask *Why?*, Type Two ask *What?*, Type Three ask *How?*, and Type Four ask *What if?*. Figure 1 displays the LSI's sequential and circular learning pattern.

Kolb observes that learning styles are influenced by personality, academic training, current job and task, and career choice (Kolb, 1986). Divergers, for instance, tend to be trained in the humanities or social sciences, while physical science-based professionals are typically Convergers or Assimilators, and administrators/business oriented or academicians generally tend to be Accomodators or Convergers (Bilgan, 1973; Kolb, 1976). Approximately one of every five individuals tested demonstrates two different learning styles; presumably these individuals require both styles in order to accomplish tasks requiring different skills.



Study type is another variable that impacts the student's learning process. The *constructive student* is an independent learner who works at her or his own pace, and attempts to discover relationships between new information and principles, and the student's past experiences and values. In contrast, a *defensive learner* is more concerned with conforming to established standards, so that performance on homework and tests is a major concern, and focuses on details and memorization of presented material. Instructional methods that help motivate the constructive student include self-paced learning plans, unstructured assignments, and inquiry or discovery methods, while the defensive learner requires clear learning objectives, frequent review and summarization of the material, and regular testing.

INSTRUCTIONAL PROCESS VARIABLES

Rumelhart and Nelson distinguish between *Procedural* objectives, which require learning a series or sequence of steps, and *Declarative* objectives, which include concepts and principles that can be applied to solve "new" problems (Rumelhart & Norman, 1981; Clark & Voogel, 1985). Examples of procedural objectives are task-related competency-based skills that course graduates need to perform on the job, while declarative objectives are typically taught in a course in which students must integrate and synthesize basic concepts in order to solve complex problems.

Figure 1 also provides examples of teaching methods and students activities, each of which is listed under the corresponding learning dimension of the LSI (McCarthy, 1980). Due to their cognitive nature, the Reflective Observation and Abstract Conceptualization methods require examination or explanation, as students mentally interact with the instructional material in order to modify previous knowledge (Clark and Voogel, 1985). Active Experimentation and Concrete Experience, on the other hand, require application and concrete realization, which are behavioral processes. Typically such behavioral teaching methods involve: (1) procedural objectives that influence instruction and evaluation, (2) techniques that direct and monitor student progress, and (3) instructional sessions in which language is standardized, practice is encouraged, and corrective feedback and reinforcement are provided.

This overview of the literature has focused on two vital ingredients of the learning process: student learning and instructor teaching variables. Multimedia can be part of the learning environment as well as the means by which instruction is formatted and stored, thereby impacting both learning style and teaching method variables (Schwen, 1977). Next, selected multimedia are briefly reviewed.

MULTIMEDIA EDUCATIONAL APPLICATIONS

Electronic, computer and video technologies have been utilized by educators to aid in developing critical thinking and functional-competencies of students, including computer-based simulations (Cadotte & Rinehart, 1986) and expert systems (Cook & Jenicke, 1989), video-taped cases (Doutt, 1979) and role-playing (Castleberry, 1989); audio cassette commentary on written reports (Wilkins & Madden, 1986) and computer-based grading of written case analyses (Barnes & Smith, 1986); effectiveness of audio-visual presentations (Lipson & Gur-Arie, 1981); student construction of examination questions on the microcomputer (McIntyre & Munson, (1986); and a teleconferencing application for the classroom (Murdock & Bellizzi, 1981). Rapid advances in several related disciplines have contributed to the continually expanding applications of electronic technologies for instructional uses such as computer-generated audio-visual (A/V) aids, computer-based training (CBT), interactive video instruction (IVI), and multimedia classrooms.

MEDIA EFFECTIVENESS

Benefits of IVI include consistent teaching delivery and more efficient student learning: Leadership Studies, Inc. found greater retention and 50% more rapid learning using the Situational Leadership IVI (1990). Andersen Consulting found training time to be reduced 30-50% on average with IVI, and IBM observed that the Advanced Technology Classroom (ATC) significantly reduces classroom time and improves learning by as much as 40 percent (1989).

Such impressive findings should not, of course, be taken to mean that media educational delivery is a uniquely effective educational tool, in and of itself. Clark, for instance, concludes that the educational content delivered by media, and not the media per se, influences learning (Clark, 1983). To support this position, he points to possible uncontrolled effects of instructional method, or of content differences between treatments that are compared, and to the novelty of the new media, which seems to dissipate over time. However, although he argues that media delivery vehicles do not directly impact learning, nonetheless he agrees that particular characteristics of some media may provide conditions that assist in the learning process (Frontczak, 1990b; Clark, 1985; Clark, 1987).

On the other hand, different individuals tend to prefer certain media or to attribute to these media differing levels of difficulty and entertainment effect. This, in turn, could conceivably affect certain educational outcomes (Clark, 1983). Students, after all, are consumers of an educational product, and the use of media in delivering this service makes sense. Moreover, Frontczak suggests that since learning styles may have implications for career paths, a specific promotional approach and media vehicle might be useful for various LSI learning types (Frontczak, 1990a).

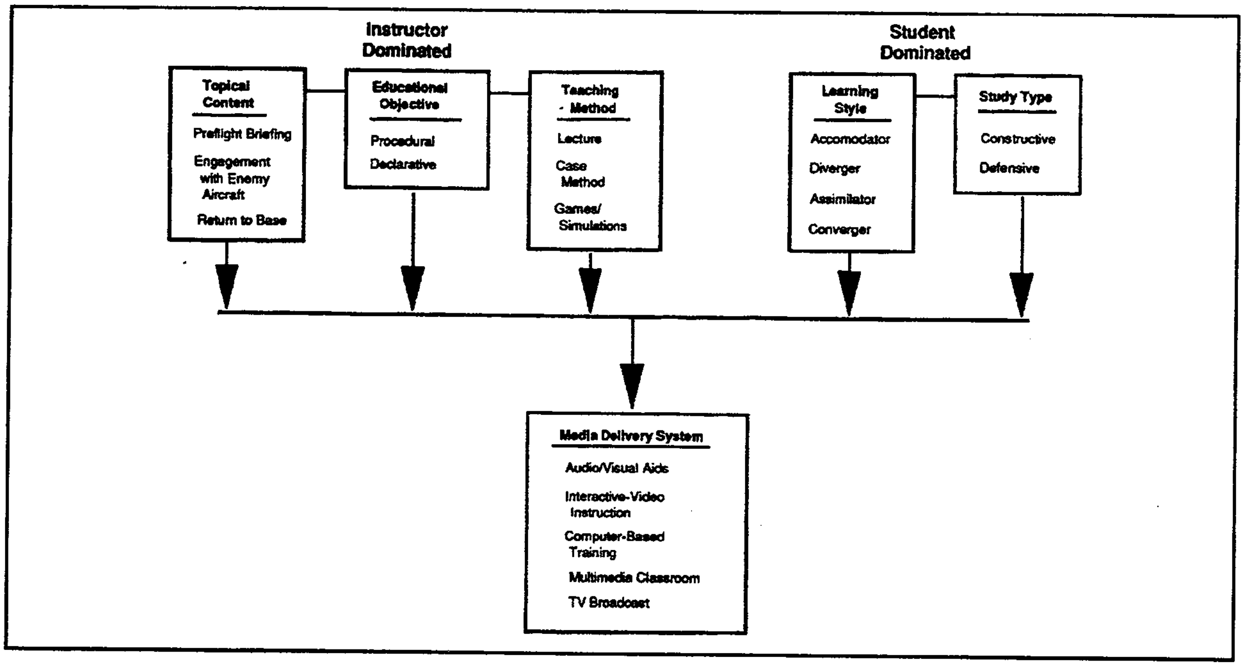
The next section of the paper introduces a framework to help guide educators in selecting an appropriate medium to achieve selected educational objectives.

USING MULTIMEDIA TECHNOLOGY TO LINK STUDENT-DOMINATED VARIABLES WITH INSTRUCTOR-DOMINATED VARIABLES

Figure 2, Page 8 is intended to link student-dominated and instructor-dominated variables with media delivery systems, allowing educators to simultaneously consider teaching and learning variables when selecting a media system. The arrows depict an interactive relationship among the instructor and student variables. For example, an instructor would be influenced by her or his selection of a teaching method by the particular educational objective, while a student's learning style likely impacts her or his attitude and motivation towards study.

This figure and the literature review suggest a number of directions in which educators might move when deciding upon a media delivery system. Utilizing Figure 2 in conjunction with Figure 1 should provide instructors a level of assurance that the media system planned for their courses can be partially supported on empirical and conceptual grounds.

Clearly, an important first question when using this framework is "where to begin?" Although it is beyond the scope of this paper, educators first need to consider larger curriculum issues, so that courses can be constructed and sequenced according to the learning needs of the students and the teaching objectives of the instructors. Furthermore, courses can be interrelated in such a way that each bears a relationship to the others in terms of content and learning objectives, thus helping to insure an appropriate mix of complementary and supplementary materials. In this way educators can have some confidence that the student has had the opportunity to acquire both task-related and critical thinking skills.



IMPLICATIONS FOR STUDENTS, EDUCATORS AND RESEARCHERS

Students would benefit from this media/learning process approach in at least two ways. First, students are afforded the opportunity to learn in a manner more consistent with their preferred learning and study styles. Just as importantly, they can also be trained to develop both behavioral and cognitive skills that will be necessary to successfully complete tasks that are vital to accomplishment of a mission in the field of aviation.

Second, media educational modules that are explicitly designed to integrate teaching methods, content objectives, and student learning and study types reasonably increase the opportunity for all individuals to reach their highest potential. Logically, performance by students working in these circumstances should exceed that of those who lack the benefit of learning systems particularly designed to work with their characteristic learning styles.

Similarly, this approach provides several advantages to educators. First, instructors can begin to model training in terms of an interrelated set composed of teaching method, learning/teaching styles and objectives, and multimedia. This in turn increases the likelihood of meeting the educational goals within the training environment. Second, multimedia system designers can choose a variety of technologies in order to provide a training simulation which can maximize the learning environment, since they are able to consider the interactive effects of student and instructor variables. Third, educators should be able to increase both the efficiency and the effectiveness of their teaching programs. Classroom and self-study periods carry the potential of providing nearly optimal conditions for learning, simply because they have been designed more specifically for this purpose. Efficiency may be realized by savings in: (1) the time required for a student to achieve an objective, (2) the cost of developing an instructional program, (3) financial resources for committed facilities, and (4) the cost of access to media by students. Lastly, the effectiveness of any particular course is often measured in terms of both quantity and quality, quantity usually being determined on the basis of the number of concepts presented during the term. Quality can be judged from the perspectives of both the student and the instructor: students rate the instructor and course on evaluation forms, while instructors assess performance graded exercises as one indicator of excellence in learning concepts. In each case, however, these measurements fail to capture all the key components of the learning process. Realistically, instructors and students will give high scores on quantity and quality to a course whose design incorporates important learning variables.

This learning process approach also suggests several directions for investigation by researchers. First, preliminary evidence indicates a relationship between media teaching method and educational objectives. Research exploring this relationship, through experimental design and/or field studies utilizing causal modeling techniques is necessary to determine the extent of the association, and what the potential mediating and moderating variables are. Second, certain concepts or topics may lend themselves more readily to the use of media delivery systems. Moreover, certain topics may be more suited to *Procedural*, or task-related, versus *Declarative* or critical thinking objectives. Intuitively, one's attitude and motivation towards either educational objective would appear dependent upon the student study type. Thus, field studies investigating which methods are more successful with which topics is an important avenue to pursue.

Given the variety of teaching methods and media delivery options, the issue of multimedia andragogy and pedagogy provides a focus for additional research regarding what combination of teaching methods is most likely to result in: (1) the rapid achievement of learning objectives, (2) the greatest benefit to each student's learning style, (3) the most appeal to either the constructive or defensive study type, and (4) the optimal design for a particular course or sequence in an educational program. As noted in this paper, both experimental designs and causal modeling techniques could provide methodologies to test hypotheses.

CONCLUSION

Media learning process models hold promise for advancing andragogy and pedagogy. Improvements in computer and electronic technologies can dramatically affect both student and teacher variables within the learning process. Certainly developing and implementing efficient and effective media learning systems for courses will be expensive in terms of financial, technical, and resource commitments by instructors, administrators, publishers, and software and hardware designers. Yet our students deserve continued efforts to provide the best educational technology, andragogy and pedagogy available. Exploring multimedia educational systems which are based on Kolb's Learning Model is one way of addressing these challenges.

REFERENCES

Andersen Consulting (1989). **Computer-Based Applications Bulletin**, Lake Charles, IL: Andersen Consulting, Arthur Andersen & Co., SC.

Barnes, H. & Smith, S. (1988). "Improving Case Evaluations Through Computer-Based Grading: An Experiment Applying a Developmental Model to Case Evaluation," Journal of Marketing Education, Summer, 63-73.

Bilgan, A. ((1973). "The Characteristics of Subject Matter in Different Academic Areas," Journal of Applied Psychology, 57, 195-203.

Cadotte, E. & Rinehart, L. (1986). "'Chips': A Strategic Distribution Game," Journal of Marketing Education, Summer, 51-58.

Castleberry, S. (1989). "Videotaped Role Playing in the Personal Selling Classroom," Journal of Marketing Education, Spring, 33-39.

Certo, S. & Lamb, S. (1980). Investigation of Bias Within the Learning Style Inventory Through Factor Analysis," Journal of Experiential Learning and Simulation, 2 (June), 1-7.

Clark, R. (1983). "Reconsidering Research on Learning from Media," Review of Educational Research, Winter, 53(4), 445-459.

Clark, R. (1984). "Current Findings on Motivational Techniques," CMLEA Journal, 7(2), 4-5.

Clark, R. (1985). "Evidence from Confounding in Computer-Based Instruction Studies: Analyzing the Meta-Analyses," ECTJ, 33(4), 249-262.

Clark, R. (1987). "A Psychological Perspective on Six Arguments Concerning the Use of Media in Education," lecture delivered to Spanish Universities by Invitation of Spanish-North American Joint Committee.

Clark, R. & Voogel, A (1985). "Transfer of Training Principles for Instructional Design," ECTJ, 33(2), 113-123.

Cook, R. & Jenicke, L. (1989). "Expert Systems Technology Applied to Marketing Decision Making: An Interdisciplinary Term Project," Journal of Marketing Education, Spring, 45-52.

Dorsey, O. & Pierson, M. (1984). "A Descriptive Study of Adult Learning Styles in a Nontraditional Program," Lifelong Learning, 7(8), 8-11.

Doutt, J. (1979). "Marketing Case-Study Analysis Using Video-Tape Simulation," Journal of Marketing Education, November, 79-81.

Eison, J. (1979). "A New Instrument for Assessing Students' Orientations Towards Grades and Learning," Psychological Reports, 48, 919-924.

Frontczak, N. (1990a). "Consumer Learning Styles: Implications for Promotional Strategy," in Proceedings of the Thirteenth Annual Conference of the Academy of Marketing Science, Vol. XIII, B.J. Dunlap, ed., Academy of Marketing Science, 330-334.

Frontczak, N. (1990b). "The Role of Learning Styles in Marketing Education," in Western Marketing Educators' Association 1990 Conference Proceedings, Jeffrey T. Doutt and Gary F. McKinnon, eds., Provo, UT: The Brigham Young University Press, 57-62.

Gail, T. & Calvert, S. (1984). "Learning Style as a Predictor of Student Performance and Instructor Evaluations," Journal of Marketing Education, Summer, 14-17.

Hunsaker, J. (1980). "The Experiential Learning Model and the Learning Style Inventory: An Assessment of Current Findings," Journal of Experiential Learning and Simulation, 2 (September), 145-152.

Kolb, D. (1976). **The Learning Style Inventory: Technical Manual**. Boston, MA: McBer and Company.

Kolb, D. (1986). **User Memorandum**. Boston, MA: McBer and Company.
Leadership Studies, Inc. (1990). Promotional Literature for Situational Leadership Interactive Videodisk Instruction, Escondido, CA.

Lipson, H. & Gur-Arie, O. (1981). "The Effectiveness of Audio-Visual Presentation," Journal of Marketing Education, Spring, 46-49.

McIntyre, S. & Munnson, J. (1986). "A Testing Experiment in the Principles Course: Students Learn More by Composing Test Questions on a Microcomputer," Journal of Marketing Education, Summer, 39-46.

Murdock, G. & Bellizzi, J. (1981). "Teaching Marketing with Telecommunications:

Conference Calls Bring Corporate Executives into the Classroom," Journal of Marketing Education, Spring, 42-45.

McCarthy, B. (1980). **The 4-MAT System: Teaching to Learning Styles with Right/Left Mode Techniques**, Barrington, IL: EXCEL Inc.

Rumelhart, D. & Norman, D. (1981). "Analogical Processes in Learning," in **Cognitive Skills and Their Acquisition**, J.R. Anderson, ed., Hillsdale, NJ: Lawrence Erlbaum.

Schwen, J. (1977). "Professional Scholarship in Educational Technology: Criteria for Inquiry," AV Communication Review, 25, 35-79.

Svinicki, M. & Dixon, N. (1987). "The Kolb Model Modified for Classroom Activities," College Teaching, 35(4), 141-146.

U.S. Department of Education (1984). Study Group on the Conditions of Excellence in American Higher Education, Involvement in **Training: Realizing the Potential of American Higher Education**, Washington, D.C.: National Institute of Education.

Wilkins, H. & Madden, R. (1986). "An Analysis of How Marketing Students Perceived Benefits from Cassette Tape-Recorded Instructor Commentary on Writing Efforts," Journal of Marketing Education, Spring, 61-65.

TRADITIONAL VERSUS TECHNOLOGICAL APPROACHES TO TEACHING MATHEMATICS AND PHYSICS

by

Loren L. Vian
Adjunct Assistant Professor
Embry-Riddle Aeronautical University
College of Career Education, Fort Lewis Resident Center, Washington

TRADITIONAL VERSUS TECHNOLOGICAL APPROACHES TO TEACHING MATHEMATICS AND PHYSICS

by Loren L. Vian

Abstract

The use of technology in the classroom can be an integral part of the learning process. It allows the instructor the freedom to explore a broader range of problems, concepts, or activities. The technology can reduce the long "busy work" problems to a few minutes without diminishing any of the concepts. The problems may be real without the "nice" numbers to make the calculations easier. The student and instructor may explore several variations of the problem in a short time with little effort. The laser disk opens other possibilities to bring in examples too costly for many laboratories or classrooms. The inclusion of technology in the classroom presents many interesting challenges to the instructor and student.

Introduction

The students and classroom has changed significantly over the past two decades. The method of instruction must also be changed to adapt to the changing times, students, technologies and job opportunities.

Traditionally mathematics has been a rather boring subject for most students. The ones who enjoyed it either found it easy or enjoyed the challenge of solving the problems. The rest of the students tolerated it long enough to get the credit for the course. The technology can increase the interest for the later group and even create some excitement while being successful with some of the problems.

The teaching of mathematics and physics has several levels of technology that may be used in the classroom or by the student. The first level being the chalkboard, overhead projector with transparencies, and models of the various curves or solids. This is the main support for the traditional methods. The instructor lectures on the concept, possibly aided with overhead transparencies and/or models. The students questions are addressed at the appropriate time or as time allows. The class period is dominated by the instructor with the majority of the feedback coming from test results. The instructor is very much in control of what is happening in the classroom all the time. The students may use their calculators on the homework and/or test.

The second level of technology is using the graphing calculators and/or other student affordable electronic devices. These devices may be used for classroom demonstrations purposes or by the student to explore the properties of functions. They can supply the student with a lot of support as he/she explores the patterns of mathematics and collected data. The graphing calculator will give the student a chance to start exploring the patterns of mathematics and/or analyzing data.

The third level is to make full use of the computer and other hardware with the various mathematics and physics software programs that are available on the market. These programs will do various things from collecting data, graphing it, fitting a curve to it and rotating the curve for different views. They will integrate, differential, and solve various types of equations as examples of their capabilities. The statistical software will give plots of the data to show distribution and also have curve fitting and analysis capabilities. The classroom will become a mathematics laboratory part of the time while studying and analyzing the real life data. These projects may be complex enough to require several days work and or the effort of several students working together. The instructor's role as the focal point of the class is diminished, the technology and what can be done with it starts controlling the direction of the class.

To feel comfortable using any or all of the possible technology in the mathematics and physics classroom, one must move away from the traditional meaning of mathematics. The average person will define mathematics as a lot of numbers and/or letters (variables) that created confusion they didn't understand

(and probably could care less about). Unfortunately their mathematics definition and experiences didn't include anything about reasoning, real problem solving, patterns, data collection and analysis. These are the areas that the student really needs to have some skills upon completing the mathematics sequence. The reasoning is short circuited with ideal problems in which a pattern or sequence of steps are memorized. The problem solving amounts to learning the methods for solving equations in algebra and/or the related simple word problems. No real life problems from outside of the textbook are ever explored. The use of technology will allow the student to move beyond the simple problems, with all the ideal numbers, that can be worked on paper in a few minutes.

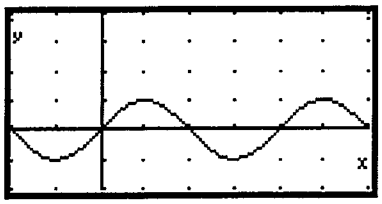
Using technology allows and encourages the student to explore different approaches (graphical, numerical, symbolic, etc.) The calculator and computer are very obedient. They do what they are told. The student must still be able to reason through the process of what they are trying to find and be able to recognize a reasonable answer when it occurs. Technology can't be a substitute for not knowing anything. Most still require knowing the general procedure of solving the problem.

Application of Technology

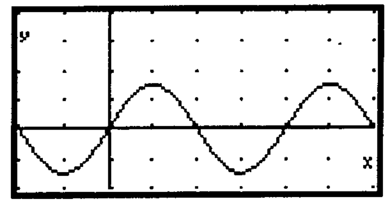
The amount of technology used in the classroom varies with the instructor and/or the amount available. I use the Texas Instrument - 85 graphing calculator, the Macintosh computer (*Theorist*® and *Maple*® software), and data sensors and collectors in the classroom.

The TI-85 can be purchased with a view screen that will fit on the overhead projector. Anything that is displayed on the calculator's screen is also projected by the overhead. The hardware and software is also available to connect the calculator to either an IBM/compatible or Macintosh computer. The two pieces of technology can exchange data, graphs, etc. to extend the applications or extend the memory of either. I have drawn graphs on the calculator and transferred them to the computer to be pasted into a test or problem exercise. They can also be enlarged and printed to make permanent transparencies for the overhead. Two TI-85 calculators can also "talk" to each other and exchange programs, data, etc. This has proved to be a useful "tool" for sharing information with the students who may also have TI-85 calculator.

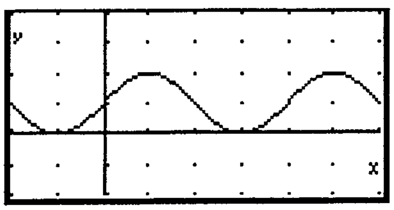
I have used the graphing calculator in all of the classes that involve the sketching of graphs. The MA-111, College Mathematics for Aviation I, involves sketching graphs of the various trigonometry functions and some polynomial functions. The graphs below, produced by the TI-85 calculator are an example for the sine function. All of the graphs involving the sine function are variations of the graph of $y = \sin x$. They are just shifted up or down, right or left, and either stretched or compressed horizontally or vertically.



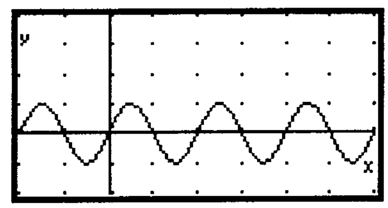
y = sin x



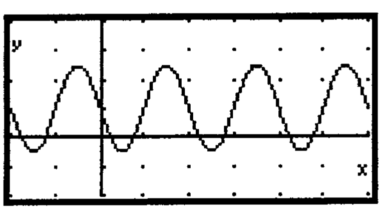
y = 1.5 sin x



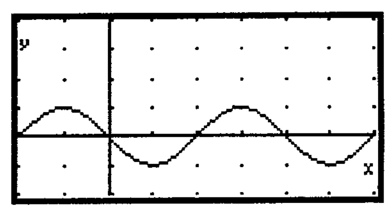
y = 1 + sin x



y = sin (2x)



y = 1 + 1.5 sin (2x + π)

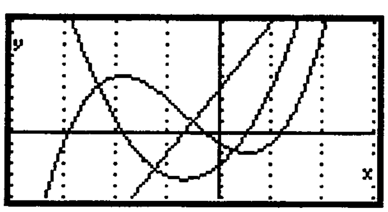


y = sin (x + π)

A rule from the sequence of graphs: The "1.5" changed the amplitude by a factor of 1.5 (stretched the graph vertically), the "1" shifted the graph up one unit vertically, the "2" was the number of cycles in 2π radians or 360° (compressed the graph horizontally or the period is $2\pi/2$) and the "π" shifts the graph left one half a cycle (horizontal shift in the opposite direction of the sign).

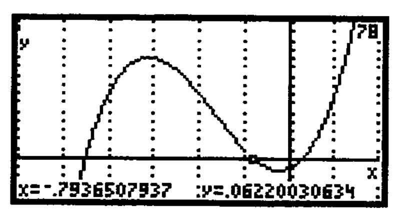
The patterns can be demonstrated in a few minutes using the calculator. I really prefer letting the students "discover" the affect of each of the various numbers in the function and the resulting affect on the graph. They can then formulate and check their own rules for future use. This is particularly nice when projected on a white board so comments may be added to the graphs along with the rules. This process can be done with any of the trigonometry functions, polynomial functions, or rational functions.

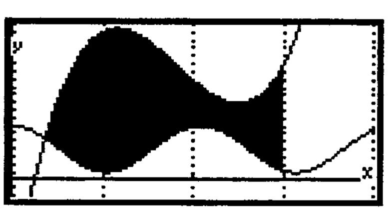
In the MA-112, College Mathematics for Aviation II, the graphing calculator is used to show the limits, local maximums, local minimums, zeroes of the function, etc. that the student has struggled to find with the calculus. The calculator will sketch a graph of the curve and shade the area that is found by the integration process. It will also do the integration by a numerical process to provide a value for the amount shaded. Examples of these graphs are shown below.



Polynomial max/min,
relationship of derivatives
$y = x^3 + 2x^2 - 3x - 1$

Zero of the function
$y = x^3 + 5x^2 + 2x - 1$





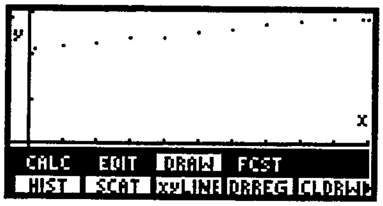
Integration
$x = .7421$ to $x = 6$
$y = 3 \cos (1.5x) + 4$
$y = x^3 - 11x^2 + 35x - 15$

Other models, such as the HP-48G, will draw 3-D graphs for used in the rotation of a solid and volume problems or other applications in Multivariable Calculus.

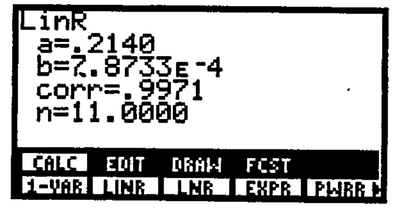
In Statistics classes, such as MA-211, Statistics with Aviation Applications, the statistics package on the TI-85 calculator may be used. The data may be entered into the calculator for analysis by any of the several programs. If there are a few data points the calculator can plot a histogram, a scatter diagram, and fit a curve (function) to the points, including the correlation coefficient to characterize how well it fits the data. The regression function may be up to fourth order polynomial function, a power function, an exponential function or logarithmic function. An example using the data from a gas law physics experiment to predict the value of absolute zero is given below.

Volume*	Temp
.289 m	98°C
.285 m	90°C
.279 m	80°C
.271 m	70°C
.259 m	60°C
.256 m	50°C
.242 m	40°C
.239 m	30°C
.230 m	20°C
.222 m	10°C
.215 m	2°C

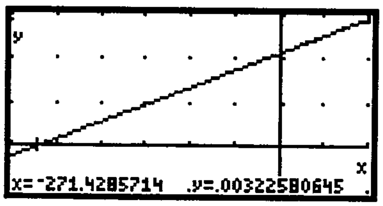
*Volume is proportional to the length of capillary tube.



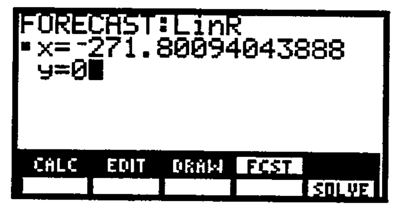
Graph of data



Regression equation and
correlation coefficient
V = 0.00078733 + 0.2140



Linear regression equation



Predicted Absolute zero

This type of problem is often outside of the introductory statistics course due to the difficulty of making all of the calculations error free and possibly collecting the data itself. Without the help of the statistics software, this type of problem turns out to be "busy work" problems. More time is spent doing the calculations and graphs than is spent actually analyzing the data.

I also teach in the mathematics and physics departments at Centralia College, Centralia, WA. Most of the students, in the trigonometry course and above, have graphing calculators of some type. I used the calculator as mentioned above whenever possible. In addition to those examples, I also provide data or have the student collect data from physics experiments. This data is analyzed using the math concepts available to the student at that time. Few of the numbers are the "nice" numbers typically found in the textbook. They are closer to what the student may experience in the real world outside the classroom. The student will have few preconceived conclusions about the problem. Textbook problems are grouped together by type and method of solution. They are also ranked in order of difficulty. They are willing to tackle the problem to "play" with the calculator or computer. The student will work/struggle through it with the appropriate guidance when needed.

The calculus and physics students are stepped up to the next level of technology, the use of the computer. The computer is used to do some modeling of a physics experiment or its result. The spread sheet is a useful tool for that purpose. The data can be entered and various forms of a model tried. The results are compared to the theoretical and observed. The student can try small perbutation in the model/system to find optimum results. Sensor units are available in the physics lab to collect the data and enter it directly into the computer. The software provided with the sensors will provide graphs to help with the analysis of the data.

The Macintosh computer lab, at Centralia College, has the mathematics software *Theorist®* available on many of the computers. This software is a very powerful tool in demonstrating mathematical methods from elementary algebra to differential equations. It requires the student to know the procedure. When instructed, the computer obeys and makes whatever symbolic or numerical calculation. It will not solve the problem with out the step by step instruction from the student. It is a very good symbolic mathematical software. It is capable of sketching 3-D graphs, rotate the graphs in space, or resize them for a better view of a certain part.

Merely having the technology available is not sufficient. The instructor must use it in the classroom and in assignments whenever possible. Textbooks are available that have been revised to make use of the various technology, such as in the reform calculus. The "revisions" range from adding a few calculator problems to the traditional textbook to completely new textbooks that rely heavily on technology in the course. Workbooks or lab books are available in many subjects to supplement the present course or textbook.

The laser disc has also changed the environment of the classroom. The laser disc combines the best of the movies and slides. One can stop and view a particular frame without fear of destroying the film, may run the disc at various speeds to create the affect of slow motion, or go directly to a particular frame. They are bar coded to increase the ease of entering frame numbers. The quantity and quality of material on laser disc has greatly improved in recent years.

In the physics courses, I use the laser disc to show/demonstrate a number of the principles of physics or experiments in physics that I can't do with the equipment available in our physics lab. The demonstrations on the laser disc are about one minute in length. They require little time to setup and show. They are used to enhance or start a discussion of some particular concept. The sound may be turned off and the student is asked to explain the physics of the demonstration as a quiz/test question. They find them very stimulating and prompts them to start looking at the physics in their everyday life. The laser disc could be applicable to any subject area.

The use of the *Interactive Physics®* software is very nice to model concept of physics. It actually provides a computer simulation lab for the student to study the concepts in a trial and error atmosphere. It allows the student to change parameters and observe the results. For example, how does the muzzle velocity (angle and magnitude) affect the range of the projectile? a lab can be designed to allow the velocity vector to be adjusted for various angles and magnitudes. A graph of the projectile is traced on the screen. The affects of the change in angle or magnitude is observed from the graph (a trace of the projectile's path). This type of use of technology allows the student to "explore" physics.

The physics lab is making use of the computer and other technology. Experiments have been rewritten to use sensors to make the various measurements. The motion sensor will measure the position of an object as a function of time and store the data in the computer. Graphs of postion vs time, velocity vs time, acceleration vs time are possible from the motion sensor. The force probe produces a force vs time graph and the temperature probe produces the temperature vs time graph. Graphs are also produced from the electricity and magnetism areas.

These graphs are analyzed using the concepts of calculus for the slope (derivative) and area under the curve (integration). The results are discussed in terms of the meaning and other applications. The data can be stored in a spread sheet and analyized. The technology is used for the majority of the lab report - listing data, graphs, many of the calculations, and the word processor to print a readable report. Sketches of the equipment setup are usually drawn using a pencil.

Results of Using Technology in the Classroom

The inclusion of technology in the classroom has changed the "atmosphere" of the classroom. The instructor must have a broader view of the subject matter and be open to other approaches. The problems can be an order of magnitude more difficult due to the "ugly" numbers and real life situations that can be included. The students are questioned and work on the concepts and approaches to the problem, instead of a final answer from a memorized sequence of steps or formal proofs. They start forming ways to think through a problem, to model the problem, and finally to solve the problem.

I give the calculus students a real life problem or data from a physics lab experiment, for them to analyze, about every other week. It does not always match what they are doing in class during that week. They may have to look a few days ahead for a clue on how the handle part of the problem or regress several weeks to find methods or combinations of methods to solve the problem. They looked forward to these applied problems.

I no longer work a calculus or physics problem before I include it as part of a test. The tests are of the take home variety, where they may use anything that is not living (no friends or other people who may be knowledgeable in mathematics or physics) to do the test. The students usually have at least 48 hours to do the test. They are to provide solutions or valid explanations why they could not do a problem. They also know that a second chance at one of the problems will be facing them once the test is corrected. The second chance is usually on a problem they struggled with, but just couldn't get by some point. This encourages them to get as close to the solution as possible, because I give some clues, based on their effort, in the correcting process. The random guess doesn't provide many hints from me.

The technology can help in the courses on the different types of problems from handling "difficult" numbers or graphs to the experimenting and discovering things about different functions. It can also require the instructor to be more creative in their questions. For example, the old question of sketching a graph of a given function, is a give-away when everyone has graphing calculators. The question may be revised so the graph will have a small bend that would not show up on the calculator display or the student is ask to provide other information about the graph, such as location of maximums and minimums. Another version that will take the graphing calculator out of the question, except to check the answer, is to give the graph or data points and ask the student to write the function to match the graph.

The use of technology in the classroom can be an asset, if used in a productive manner to enhance the students understanding of the course material. It is not a substitute for the instructor. It expands the capabilities of the student and instructor to better understand the concepts and helps prepare the student for the technology competitive job world.

Theorist® is a registered trademark of Prescience Corporation, San Francisco, CA.

Maple® is a registered trademark of Waterloo Maple Software.

Interactive Physics® is a registered trademark of Knowledge Revolution, San Mateo, CA.

References

Cross, K. Patricia and Angelo, Thomas A. (1988). Classroom Assessment Techniques: A Handbook for Faculty. Ann Arbor: The University of Michigan Press.

Ellis, W., Johnson, E., Lodi, E., Schawalbe, D., (1992). Maple® V Flight Manual. Pacific Grove,California: Brooks/Cole Publishing Company.

Staff of Texas Instruments Instructional Communications. (1992). TI-85 Advance Scientific Calculator Guidebook. Lubbock,Texas: Texas Instruments Corporation

Staff of Prescience Corporation. (1990). Theorist® Learning Guide. San Francisco: Prescience Corporation.

Staib, Jon A. (1995). Discovery Exercises for Interactive Physics to Accompy College Physics, 4th Ed. Orlando: Harcourt Brace & Company.

THE FORGOTTEN DIMENSIONS OF TEACHING?

by

David M. Keithly, Ph.D.
Adjunct Associate Professor
Embry-Riddle Aeronautical University
College of Career Education, NAS Norfolk Resident Center, Virginia

THE FORGOTTEN DIMENSIONS OF TEACHING?

by David M. Keithley, Ph.D.

In discussions of technological innovations in education, basic and time-honored aspects of teaching are too often omitted. Analyses are at times regrettably narrow in scope, unsatisfactory in their neglect to integrate the old with the new. The purpose of this paper is to reflect upon certain rudiments of teaching with specific reference to the role of the teacher and to affective aspects of education. To say it all at once: in discussing innovation one must be heedful of basics. Technological advances can, of course, facilitate learning, but technology in education, as is the case in other areas as well, must not be an end in itself, but rather a means toward an end. In education, technology should enhance teaching; never must it be a substitute for it. With technology advancing at a sometimes breathtaking tempo, there is all the more reason for teachers to ask themselves how, specifically, technology contributes to the learning process. One must be mindful of the potential pitfalls of technology utilization. And no serious educator would wish to convey the impression, however subliminal, that somehow he/she is being replaced with a machine. Thus should we regard the employment of new educational technologies and what Graham Greene so aptly referred to as the "human factor" as different sides of the same coin.

Learning involves a variety of teaching approaches, the most effective of which entail two-way, spoken communication between the teacher and the students, and equally importantly, among the students themselves (Hyman, 1980, p. 1). Salient examples include recitation, dialogue, guided discussions and role-playing. L. M. and J. R. Gibb hypothesize that students taught by the "participative action" method were significantly superior to students taught by more traditional lecture methods in both self-insight and role flexibility (Gibb and Gibb, 1951, p. 247). They also provide support for the assumption that group-centered teaching facilitates development of group membership skills (McKeachie, 1986, p. 49). "Gee-wizz" technology in the classroom is a poor substitute even for lectures, where, as most experts would agree, far less learning takes place (Gullette, 1982, pp. 38-30; Hill, 1977,pp. 49-51).

Roles of Teachers

In their research on college teaching, Solomon Cytrynbaum and Richard Mann have categorized teacher roles as follows (McKeachie, 1986, p. 53; Mann, 1970, pp. 85-87).

1. The teacher as person.
2. The teacher as facilitator
3. The teacher as socializing agent.
4. The teacher as formal authority.
5. The teacher as ego ideal.
6. The teacher as expert.

Citing these categories, Wilbert McKeachie describes each in turn. Teachers as persons, he argues, are not only addressing their own needs to recognize the self they are portraying (McKeachie, 1986, p. 64-65). They are also performing the vital task of puncturing the various mythical constructions which students may develop.

The net effect of this is both to decrease the awe in which they are often held and to increase the extent to which their interests reveal them to be ordinary mortals in pursuit of realistic and manageable educational goals.

What does this mean from the standpoint of technological innovation? Much the same thing. Just as teachers must puncture various and sundry myths about themselves, so must they assist students in overcoming uncertainties and reservations about technology. With respect to the "human factor," educators must discourage students from being overawed by technology, while at the same time showing them how technological innovation can ease and advance the learning process. I think, for example, of my unflinching encouragement in years past of the use of personal computers to develop writing skills. No one in this day and age should be processing words the old-fashioned way, i.e., writing papers in long hand, then typing them.

The teacher as facilitator tends to respond to the student's own definition of his/her goals. These goals may be quite divergent from those of the teacher, but then for one person to facilitate the learning and development of another often involves a recognition of the substantial differences between individuals in terms of what they value and what they are seeking (McKeachie, 1986, pp. 59-60). If we capture the pedagogical fervor often distinguishing some teachers who strongly emphasize the facilitator functions, we note the teacher's frequent rejection of an effort even to impose questions upon students who need to develop questions and answers that are somehow relevant to their own lives (McKeachie, 1986, p. 60). That facet of the students which connects with the teacher as facilitator might be categorized as one whose personal agenda includes not only finding out more about the course matérial but also finding out more about themselves (McKeachie, 1986, pp. 60-61). "What am I good at?" "Where do my interests lie?" "What are my ideas about a particular body of knowledge?" Student performance in the classroom is partly expressive, driven by the need to articulate new ideas and to develop some sense of ownership vis-a-vis borrowed knowledge (Banes-McConnell, 1978, pp. 78-82). The key motifs within this aspect of teaching and learning are creativity and independence. Students, for their part, should be offered the opportunity to be creative, as opposed to being restricted within the teacher's definition of what is appropriate.

So let us ask ourselves at this point: do we provide students with adequate opportunity to articulate new ideas, to be creative? Unfortunately, not often enough. What bearing does this have upon technological innovation? The short answer is: much the same as this does for the "teacher as person." Just as teachers as persons should convey to others how they sustain their interests in many matters, so the teacher as facilitator should demonstrate to students how technology can assist in their personal growth, how technology can contribute to their articulation of new ideas, and how technology can better develop their sense of ownership of old ideas. Technology in the classroom should aid students on their path to functioning creatively and independently. Accordingly, we should continuously ask ourselves: how specifically is the technology we are employing doing this? Is it doing it at all? If we find ourselves at a loss for answers on this score, a reappraisal might be in order.

As Ronald Hyman, Philip McKnight and others point out, the classroom teacher as a socializing agent can be understood only if one first realizes two things about the context in which education takes place (Hyman, 1980, p. 2; McKnight, 1978, pp. 15-16) . First, teachers are not only in possession of certain intellectual materials; they are also members of various overlapping collectives with respect to which students are either outsiders or marginal members. Second, the goals toward which students are striving typically extend far beyond the particular classroom and the particular course. Teachers are members of a community of scholars as accredited by a particular professional discipline, and as well, as is the case with Embry-Riddle Aeronautical University, members of an institution that is prominently relevant to the aspirations of students. Teachers and students are bound together in various ways within the socialization process (McKeachie, 1986, pp. 57-59).

What lessons present themselves here for technological innovation? The answers should be fairly obvious since this is probably the most important aspect of the teaching role with respect to technology. Here courses and teachers can stand or fall. Through various pedagogical approaches and through classroom technology, students should have the opportunity to be expressive and creative, to feel part of a specialized learning environment. They should be focusing on longer-term goals. They should feel comfortable with technology: if they do not, something is very wrong. A student who is lost in class or who feels overwhelmed by classroom technology will invariably be adrift outside the classroom. Technology should promote a perception on the students' part of membership, of being integrated into the learning collective.

But technology, of course, is a two-edged sword. Technological innovation can, in extreme cases, marginalize, even alienate students. If the teacher fails to demonstrate the relevance of a particular presentation, if technology obfuscates rather than complements, when classroom technology becomes an end in itself, or when the teachers themselves are not sufficiently conversant with technological innovation, then students in all likelihood will become outsiders. The learning process will not get off the ground and the teacher will be in no position to convey how his/her knowledge is relevant to the student's own interests and goals.

As McKeachie so persuasively argues, viewed from the perspective of the larger social structure of which the classroom is part, the teacher is an agent not only of instruction but of control and evaluation (McKeachie, 1986, pp. 55-56). Assignments, due dates and criteria of acceptability are all matters of concern. Pressures upon the teacher to perform the traditional functions of formal authority derive from many sources. Future employers, professional schools and university administration all insist upon purposeful and comparable standards by which to evaluate student performance. If classroom technology impinges upon the role of the teacher as a formal authority, by, for example, significantly undermining the teacher's credibility or preventing the teacher from furnishing meaningful estimates of student performance, then serious problems may present themselves. Certainly there is nothing wrong per se with a teacher being a pleasant and nice person, but at the same time the teacher must be wary of actions that could repudiate his/her inherent prerogative and authority in the classroom or to employ technology with an aim to being "objective" and thus to shun responsibility to facilitate and to manage.

A teacher might well assume an essentially "heroic" or charismatic role in the classroom and in so doing could serve in the capacity of "ego ideal" for the student (Hart and Driver, 1978, pp. 198-200). This notion is not as curious as it might initially sound. Haven't we all at some time or another found ourselves imitating in manner or in speech those we have emulated? Imitation is often the sincerest form of flattery. Haven't we as teachers encountered students attempting to replicate our teaching styles? Some teachers serve as an "ego ideal" by demonstrating their expertise, others through their infectious enthusiasm for the subject matter, yet others by their ability to render what would appear abstract to be worthwhile and germane (McKeachie, 1986, pp. 61-62). But just as a teacher's ego can be on the line in a particularly challenging course or before a somewhat difficult group, so can the student's. Students who feel intimidated by technology, overwhelmed by figures and charts, dismayed by computer programs with which they are not conversant are simply unlikely to learn. Telltale symptoms: lack of interest in the material, eyes glazed over. Sophisticated technology in extreme circumstances can result in lethargy and indifference. This facet of teaching cuts both ways as well. Students who are comfortable with new technology and new methods will gain in confidence, acquire a sense of accomplishment and be more receptive to designated standards of evaluation. At the same time, of course, students will be more favorably disposed to innovative teachers.

Teachers are joined with students in the classroom because in some form or another they possess expertise (Gullette, 1982, p. 3; Maier and Solem, 1952, p. 278) . The chief goal should be to transmit whatever information, analytical perspectives or critical viewpoints they wish the students to acquire. Relevance to the students stems from the fact that the teacher knows something the students do not yet know. To complete this picture and to realize the pertinence of this role to technological innovation, we need to inquire about the activities of students while the latter are in contact with the teacher as an expert.

What comes to mind are our own experiences of, say, listening to a lecture whose meaning seemed beyond our grasp. We might have felt an acute sense of inadequacy. It might have been in the back of our minds that we might appear foolish in public should our lack of understanding somehow be displayed. We might have simply felt bored.

Students in such a situation seek to avoid what McKeachie terms one of the greatest disasters inherent in the education process--the realization that one is over one's head, that certain information cannot be acquired with a reasonable expenditure of effort (McKeachie, 1986, p. 55). Naturally, this holds doubly true for teachers. A teacher must avoid getting in over his/her head as a result of experimentation with innovative methods or adoption of new classroom technology. To quote an old saw: if one is in a hole, it behooves one to stop digging. More to the point though, teachers who have not satisfactorily integrated the technology they are using, be this audio-visual material, new computer software, or more sophisticated viewgraphs generated by upgraded software, risk discrediting their roles as experts in the eyes of their students. They demonstrate their inability to employ new technology, and to boot, their handling of the subject matter suffers. Questions may arise in students' minds about the teacher's ability to make critical and creative judgments in the field of supposed expertise. For the teacher the issue of competence involves both the ability to comprehend and organize relevant materials as well as the facility to present this material clearly and convincingly (Kemp, 1980, pp. 34-37) . Should questions ensue on any of these matters, a disconnect between teacher and student is bound to present itself because the teacher is associated with the students first and foremost because of some form of recognized expertise.

The First-Rate Instructor

Lest I dwell unduly on potential teaching pitfalls, let us continue on a more upbeat note. Among the results of continuing research on teaching and learning is that one is able to compile a list of the core attributes that educators generally agree distinguish the most effective instructors (Armed Forces Staff College *Faculty Handbook*, 1992, p. 17). Although this list is not necessarily comprehensive or etched in granite, it should heighten one's awareness of the range of qualities needed for classroom excellence. Parenthetically, one might add that, although achieving perfection in all of them is not humanly possible, this list can serve as a guide for self-assessment, but above all as a beacon for aspiration and goal-setting.

Superior instructors, by and large:

* exude enthusiasm about their work
* continually strive to improve their teaching skills
* are organized and well prepared when they conduct classes
* present ideas clearly
* are available to students
* listen attentively to what students have to say
* treat diverse viewpoints with respect
* provide prompt feedback to students
* give due consideration to feedback on their own performance
* integrate current subject matter into their course content
* create a climate conducive to learning

What does this time-honored list have to do with technological innovation in education? Much. Most observers would agree that these are the enduring principles of good instruction. Technological refinement and the pace of change notwithstanding, it is critical that we not overlook the precepts. In all cases, new technologies can and should assist the instructor in becoming more effective. New software programs with graphic display features such as "Harvard Graphics" and "Powerpoint," if used effectively, enable instructors to update their class materials while improving their teaching skills. These should also generate instructor and student enthusiasm. Visual displays allow instructors to present ideas more clearly, to present these in fresh ways and to review material readily and more systematically. New software programs promote better organization and facilitate the integration of new subject matter into the course content. Consider for a moment how far "Microsoft" word processing programs have come in the last years. Software with direct classroom applicability will become increasingly capable and sophisticated. We should anticipate a jump in long-distance learning. The instructor might be 500 miles away, the presentation delivered by fiber optics or satellite to students, who will be able to ask and answer questions and take tests by interactive television or fax.

Crucial from the standpoint of the instructor, and I have identified these as the two subthemes of this paper, are, first, that instructors stay abreast of technological innovation with classroom application, and, second, that instructors not lose sight of basic pedagogical principles when introducing new technologies into the classroom. In short, instructors must continually ask themselves how certain technological innovation will complement their teaching.

Affective Aspects of Teaching

Let us return here to the human factor, lest we allow technology to overshadow endeavors of a profession requiring personal commitment and an individual touch. Too often, we tend to regard college as primarily, if not exclusively an intellectual or cognitive experience. Such a conception ignores at least two important considerations.

Individual students often bring to college feelings, preconceptions, interests and values that can hinder their learning or understanding of course content. On the other hand, college is about values, at least values like logical thinking, clear expression, appreciating analysis and literature, and esteeming learning. As William Cashin and Philip McKnight have so elegantly phrased it: "At a profound level, college is about what kind of person one aspires to be, what kind of world the student wants, and what life is about" (Cashin and McKnight, 1986, p. 4). This sense in each of us is what contributes to the notion of the *consensus gentium*, the standard of worth which Aristotle saw as the pivotal test of excellence, the response of numerous individuals over a long period of time (Kirsch, 1978, p. 5).

Our teaching should be value-laden, although this must be content-specific. Let us consider here the example of history as an academic discipline. History, to be savored and understood, is not just about key events in the advancement of mankind through time. It is not merely a collection of dates, and definitely not a showcase highlighting only those occasional bright moments in the otherwise bleak and savage landscape of our past, of this trail of tears that is mankind's existence on this earth. History is about ideals and beliefs, dreams and aspirations. It is the record of those tangible qualities in our being that continually urge us to strive to be the best we can ever dream to be and of the amazing sacrifices made in exceeding our grasp on those rare occasions when we chose to try, even when we did not succeed (*History Book Club Review*, Winter 1995, p. 13.). To study history honestly is also to acknowledge the much longer record of darker moments and deeds. In teaching history, we might ask ourselves, for example, how new technologies might be employed to make these ideals and beliefs, these dreams and aspirations more meaningful to students. How might these be made to "come alive"?

We need therefore to ask ourselves how classroom technologies are suited to these concerns about feelings, interests and values. Cashin offers several maxims about affective aspects of teaching. (Cashin, 1985, p. 8).

1. Know your students. Begin all presentations with something relevant to the students' interests and goals, something out

2. Be accepting rather than judgmental or evaluative. Try to focus on the correct part of a student response. Positive reinforcement will foster more learning than negative reinforcement.

3. Be patient. Discussion classes take more time to get going. The instructor most be careful not to talk too much.

4. Challenge the students, but do not threaten them. One should strive to arouse the students enough to stretch themselves, but not so much that this becomes counterproductive,. What makes this particularly difficult is that what challenges one student may distress another.

5. Use personal anecdotes. Using one's own experiences and demonstrating that one is human can facilitate the discussion if done in moderation.

6. Avoid premature agreement. One may wish to ask a student or group to argue against the apparent consensus. Or one may wish to play the devil's advocate--very carefully.

The imaginative instructor might want to deliberate how technology suitable to the classroom might contribute to these affective aspects of teaching. Obviously, few absolute rights or wrongs present themselves, nor are there hard-and-fast answers. Might, for example, visual displays be used to stimulate classroom discussion, which, in turn allows the instructor to better know his/her students? How do visual displays kindle fresh ideas? Do these assist in challenging students? Might these be employed to make personal anecdotes "come alive"? Many possibilities suggest themselves, but instructor creativity makes all the difference.

Effective Computer-Generated Visuals

Having discussed computer-generated instructional material in several contexts, let us consider some now widely accepted guidelines for the use of visuals in the classroom. (Eble, 1976, pp. 202-203; Armed Forces Staff College *Faculty Handbook,* 1992, pp. 32-38).

Regrettably few instructors have been specifically trained to design visual aids for teaching and many are too hard-pressed for time to develop these skills systematically (Kemp, 1980, pp. 1-4; Tufte, 1990, pp. 9-13). As is usually the case in human endeavors, practice makes perfect and one must experiment with visuals with an aim to determining what is effective and what is not. The purpose here is to identify problems and determine potential hazards with using classroom visual aids. Although most of these guidelines might appear fairly straightforward, with technological capabilities for classroom instruction expanding rapidly, basic guidelines become even more important.

Three chief considerations permit a subdivision of this topic: when to use a computer-generated visual aid, what it should include and how it should appear. To begin with the obvious: one should avoid duplicating something readily available. Little purpose is served in developing a projectable slide of a diagram, chart, or table that is already printed in a text or other handout that students have been issued. Even in these "high-tech" times, one might simply direct students to look at a chart or table in the textbook. One should determine whether there is a real need for an image before going to the trouble of generating visual aids. These should constitute something not readily available to the students in another form. The following criteria of acceptability should apply:

How does this visual aid complement the

presentation?
Is this reminiscent of mere "razzle-dazzle"? If so, forget it.
How does this visual aid mesh with others being employed?
Are student eyes likely to glaze over as a result of visual overload?

As previously mentioned, one must endeavor to organize and simplify one's material. It is a mistake to select charts, diagrams or graphs uncritically from a publication, even if this is considered a seminal work. As Albert Einstein once pithily remarked: "Life is complicated, simplify, simplify." A teacher of mathematics or physics, for example, must explain relatively complex formulas to students, but only the foolhardy would rely too heavily upon projecting advanced formulas and theorems, most of which appear in texts anyway, upon a classroom screen.

One should use tables only when indispensable. One might ask oneself, first, whether a table or graph is really necessary at all. Sometimes, it is. Students are inclined to view these only fleetingly or to ignore them altogether, regarding these as interruptions or merely evidence for a point the instructor is about to make in the presentation. One might try summarizing the content of a table in a few paragraphs of a discussion or showing it in an appealing visual (*USA Today* often does this well), so it can be grasped at a glance.

Lengthy and complex summaries should be broken down into a series of slides designed to simplify the salient issues for students and to allow them to interject questions. Sorting material in advance proffers the added advantages of making the material more memorable to students, assisting them in digesting the material and elucidating the material to the instructor. Showing crowded, complex, or densely illustrated graphics to impress students how complicated the subject is or out of sheer negligence is professionally irresponsible.

Visual aids are usually most effective for showing relatively simple interrelationships; chronologies; sequences of events, e.g., flow charts; and the shapes or formats of things, e.g., countries, aircraft, weather patterns (Armed Forces Staff College *Faculty Handbook*, 1992, p. 3) These are instances where straight verbal text is not the most efficient method of communication and may in fact impede rather than promote understanding (Eble, 1976, p. 204). One should avoid generating visuals of long lists or tables, such as those too often derived in detail from computer databases. These should be furnished only in printed curriculum materials. As visuals they numb the minds of student viewers and most are difficult to read.

At times one must carefully distinguish between one's own notes and the words and phrases one shows the students to aid their understanding of a topic. The language of the visual might need to be more complete and better organized than the notes the instructor uses as a prompt for a guided discussion. The most crucial difference is that the instructor presumably already knows the subject, while the students, for their part, might not yet be conversant with it and therefore need to be provided a more explicit structure. The alert student is attempting to understand the structure and relationship underpinning the elements of the particular visual aid (Armed Forces Staff College *Faculty Handbook*, 1992, p. 6). This is no place for ambiguity.

Educational research has demonstrated that it is far easier to remember a set of related elements than a group of unrelated words and phrases (McKeachie, 1986, pp. 299-301; Kozol, 1985, pp. 148-151). That knowledge underpins the entire notion "mnemonics," that is, techniques for remembering. If the words or phrases on a visual display have so little interconnectedness that viewers would be hard-pressed to grasp the significance even after careful explanation, then they are most unlikely to remember much several days later. Once an instructor has decided to develop a visual of some sort, the amount of material it contains must be restricted to what can be readily handled by the observing eye from the back of the room without straining. The requirement that all letters and characters be legible to students in the back of the room severely limits that amount of text appearing on a computer-generated visual. The particular colors used for lettering should be chosen carefully, since varying light levels affect the visibility and readability of colors differently.

Concluding Remarks

One of the joys of teaching derives from the challenge of being out on one's own, rethinking the unexplored , reflecting upon the realm of human relations and vision. Technology continues to offer new possibilities for such endeavors, but technological innovation in the classroom can only assist in the undertaking. It cannot be a surrogate for imagination and creativity. Working back and forth between experience and ideas, evidence and imagination, data and theory, one can acquire more than time and space tender (Cronin, 1986, p. 2). But in adopting new technologies for learning, one must remain cognizant of several abiding postulates of learning theory (Eble, 1976, pp. 202-205; Lowman, 1984, pp. 120-22). All are pertinent to the topic of technological innovations in education. How these pertain, of course, is largely a matter of judgment.

1. Learning is an active, continuous process. Purposeful action is better than mere repeated motions.

2. Learners can be motivated in many ways to learn specific things. Conflicting motivations can hinder learning.

3. Learning is affected by the learner's set, that is, a predisposition to react to some stimuli in a particular way.

4. Relearning is much easier than original learning. Recall is different from retention; given the right stimulus, learners can recall more than they commonly suspect.

5. Progress in learning is not uniform, but frequently reaches plateaus where the rate of learning slows appreciably.

6. Transfer of learning has been too uncritically accepted in the past. Success in learning some things may make it easier to learn others. It is possible to learn how to learn.

Teacher's Roles	Major Goals	Characteristic Skills	Sources of Student Motivation
Teacher as person	To convey the full range of human needs and skills relevant to and sustained by one's intellectual activity	Being trustworthy and warm enough to encourage students to be open	The desire to have one's life cohere
Teacher as facilitator	To promote creativity and growth in student's own terms	Sharpening student awareness of their interests and skills; to use insight to help students reach goals	Self-discovery and clarification to grow in desired direction
Teacher as socializing agent	To clarify goals and career paths beyond the course	Clarifying rewards and demands of the academic discipline	Need to clarify one's interest and calling
Teacher as formal authority	To set goals and procedures for reaching goals	Defining structure and criteria of acceptability; evaluating performance	Dependency; being assessed a good grade
Teacher as ego ideal	To convey the excitement and value of intellectual inquiry in a given field of study	Demonstrating the ultimate worthwhileness of, or personal commitment to one's educational goals	The desire for a model; a personification of one's ideals
Teacher as expert	To transmit information, the concepts and perspectives of the field	Listening; scholarly preparation, class organization and presentation	Intellectual curiosity; need for achievement

Source: Wilbert J. McKeachie, (1986) *Teaching Tips A Guidebook for the Beginning College Teacher*. 8th ed., Lexington, Mass: D.C. Health.

Philosophies of Adult Education

	CLASSICAL LIBERAL ADULT EDUCATION	BEHAVIORALIST ADULT EDUCATION	PROGRESSIVE ADULT EDUCATION	HUMANISTIC ADULT EDUCATION
PURPOSE	To develop literacy in the broadest sense	To promote behavioral change	To transmit culture and societal structure	To enhance personal growth and development
METHODS	Dialectic; lecture; study groups; critical reading and discussion	Programmed instruction; contract learning; computer assisted instruction	Problem-solving; scientific method; inductive method; experimental method	Experiential; group tasks; group discussion; team teaching; discovery method
CONCEPTS	Learning for its own sake; rational, intellectual education; classical humanism	Stimulus-response; behavior modification; competency-based mastery learning; behavioral objectives	Problem-solving; experience-based education; life-long-learning; pragmatic knowledge	Individuality; self-directedness; openness; cooperation; authenticity
LEARNER	"Renaissance person"; cultured; always a learner; seeks knowledge rather than just information; conceptual thinking	Learner takes an active role in learning; practicing new behavior; strong environmental influence	Interests and Experiences key elements in learning; people have unlimited potential to develop through education	Learner is highly motivated and self-directed
TEACHER	The expert transmitter of knowledge; directs learning process	Manager; controller; controls learning outcomes	Guides learning though educative experiences	Facilitator; partner; promotes but does not direct learning

Descriptions are excerpted from J. Elias and S. Merriam (1980), *Philosophical Foundations of Adult Education,* Malabar, FL: Robert F. Krieger Publishing Company. My purpose in providing readers with this overview is to challenge them to consider how new technologies might correspond to various philosophies of education and how technology might enhance certain approaches. I do not mean to submit there are definitive answers, only that one should remain cognizant of philosophical underpinnings when introducing new technology into the classroom. Teachers should regularly ask themselves how technological innovation will promote the learning process.

Teacher's Roles	**Major Goals**	**Characteristic Skills**	**Sources of Student Motivation**
Teacher as person	To convey the full range of human needs and skills relevant to and sustained by one's intellectual activity	Being trustworthy and warm enough to encourage students to be open	The desire to have one's life cohere
Teacher as facilitator	To promote creativity and growth in student's own terms	Sharpening student awareness of their interests and skills; to use insight to help students reach goals	Self-discovery and clarification to grow in desired direction
Teacher as socializing agent	To clarify goals and career paths beyond the course	Clarifying rewards and demands of the academic discipline	Need to clarify one's interest and calling
Teacher as formal authority	To set goals and procedures for reaching goals	Defining structure and criteria of acceptability; evaluating performance	Dependency; being assessed a good grade
Teacher as ego ideal	To convey the excitement and value of intellectual inquiry in a given field of study	Demonstrating the ultimate worthwhileness of, or personal commitment to one's educational goals	The desire for a model; a personification of one's ideals
Teacher as expert	To transmit information, the concepts and perspectives of the field	Listening; scholarly preparation, class organization and presentation	Intellectual curiosity; need for achievement

Source: Wilbert J. McKeachie, (1986) *Teaching Tips A Guidebook for the Beginning College Teacher*. 8th ed., Lexington, Mass: D.C. Health.

Philosophies of Adult Education

	CLASSICAL LIBERAL ADULT EDUCATION	BEHAVIORALIST ADULT EDUCATION	PROGRESSIVE ADULT EDUCATION	HUMANISTIC ADULT EDUCATION
PURPOSE	To develop literacy in the broadest sense	To promote behavioral change	To transmit culture and societal structure	To enhance personal growth and development
METHODS	Dialectic; lecture; study groups; critical reading and discussion	Programmed instruction; contract learning; computer assisted instruction	Problem-solving; scientific method; inductive method; experimental method	Experiential; group tasks; group discussion; team teaching; discovery method
CONCEPTS	Learning for its own sake; rational, intellectual education; classical humanism	Stimulus-response; behavior modification; competency-based mastery learning; behavioral objectives	Problem-solving; experience-based education; life-long-learning; pragmatic knowledge	Individuality; self-directedness; openness; cooperation; authenticity
LEARNER	"Renaissance person"; cultured; always a learner; seeks knowledge rather than just information; conceptual thinking	Learner takes an active role in learning; practicing new behavior; strong environmental influence	Interests and Experiences key elements in learning; people have unlimited potential to develop through education	Learner is highly motivated and self-directed
TEACHER	The expert transmitter of knowledge; directs learning process	Manager; controller; controls learning outcomes	Guides learning though educative experiences	Facilitator; partner; promotes but does not direct learning

Descriptions are excerpted from J. Elias and S. Merriam (1980), *Philosophical Foundations of Adult Education,* Malabar, FL: Robert F. Krieger Publishing Company. My purpose in providing readers with this overview is to challenge them to consider how new technologies might correspond to various philosophies of education and how technology might enhance certain approaches. I do not mean to submit there are definitive answers, only that one should remain cognizant of philosophical underpinnings when introducing new technology into the classroom. Teachers should regularly ask themselves how technological innovation will promote the learning process.

References

Armed Forces Staff College. (1992) *Faculty Handbook,* Norfolk: Armed Forces Staff College.

Banes-McConnell, P. W. (1978). "Leading Discussions," in Oliver Milton, ed., *On College Teaching: A Guide to Contemporary Practices*, San Francisco: Jossey-Bass.

Cashin, William E. (1985). *Improving Lectures.* Manhattan KS: Kansas State University Center for Faculty Evaluation and Development.

Cashin, William E. and McKnight, Philip C. (1986). *Improving Discussions.* Manhattan KS: Kansas State University Center for Faculty Evaluation and Development.

Cronin, Thomas E. (Spring 1986). "The Write Stuff," *News for Teachers of Political Science.*

Eble, K. E. (1976). *The Craft of Teaching,* San Francisco: Jossey-Bass.

Elias, J. and Merriam S. (1980). *Philosophical Foundations of Adult Education.* Malabor FL: Krieger Publishing Co.

Gibb, L. M. and Gibb, J. R. (1951). "The Effects of the Use of Participative Action Groups in a Course in General Psychology," *American Psychologist*, 6.

Gullette, M. M. (1982). *The Art and Craft of Teaching.* Cambridge, MA: Harvard Danforth Center for Teaching and Learning.

Hart, James and Driver, James. (1978). "Teacher Evaluation as a Function of Student and Instructor Personality," *Teaching of Psychology,* 5.

Hill, W. F. (1977). *Learning Through Discussion.* Beverly Hills: Sage.

History Book Club Review. Winter, 1995.

Hyman, Ronald T. (1980). *Improving Discussion Leadership.* New York: Teachers College Press.

Kemp, John. (1980). *Planning and Producing Audiovisual Materials,* 4th ed. New York: Harper and Row.

Kirsch, Robert. (1978). "The Importance of Book Reviewing," in Sylvia E. Kamerman, ed. *Book Reviewing.* Boston: The Writer, Inc.

Kozol, James. (1985). *Illiterate America.* New York: Anchor Press/Doubleday.

Lowman, J. (1984). *Mastering the Techniques of Teaching.* San Francisco: Jossey-Bass.

Maier, N. R. F. and Solem, A. R. (1952). "The Contribution of a Discussion Leader to the Quality of Group Thinking, " *Human Relations 5.*

Mann, R. D. et al. (1970). *The College Classroom..* New York: Wiley.

McKeachie, Wilbert J. (1986). *Teaching Tips A Guidebook for the Beginning College Teacher,* 8th ed., Lexington, MA: D.C. Health.

McKnight, P. C. (1978). *On Guiding Discussions.* Manhattan, KS: Kansas State University, Center for Faculty Evaluation and Development.

Tufte, Edward R. (1990). *The Visual Display of Quantitative Information.* Cheshire, CT: Graphics Press.

TECHNOLOGY:
AN ESSENTIAL COMPONENT OF TODAY'S COLLEGE EDUCATION

by

Dr. William F. Herlehy, III, Ph.D.,
Associate Professor of Aviation Business Administration
Embry-Riddle Aeronautical University
College of Career Education, Andrews AFB Resident Center, Maryland

TECHNOLOGY:

An Essential Component of Today's College Education

The Curriculum The Delivery System

ABSTRACT

The growing educational failures of the colleges and universities of the United States are a major concern of the 1990's and are not showing a great deal of promise for the 21st century. The overabundance of committee reports that describe and prescribe for our schools, the evidence presented in those reports, and the analyses that are offered combine to form a persuasive argument that there is a profound crisis (AACC, 1995).

Technological developments have so outpaced the understanding of it provided by almost all college programs that we have become a people who are unable to comprehend the technology we invent and the impact it has on our ethical and moral fiber--our very way of life. We are unable to measure, much less control, the capacity of our technology to violate the natural laws of our world.

Technology has become a permanent, pervasive, and significant part of our culture. Yet it is a rare event to find a curriculum that exposes one to some appropriate combination of technology, innovation, the humanities, and the social sciences.

An engineering curriculum without a cultural component is not an education that will serve the graduate well in our society. Standards established by the Accreditation Board for Engineering and Technology (ABET) have done much to vindicate engineering faculty of the perceived lack of broadening within their curriculum. We must continue to strengthen the cultural component of the engineering curriculum. If we accept science and technology as essential to solving some of the world's most significant problems, applied science, computer science and applied mathematics courses must, of necessity, be included in traditionally non-technical curricula. We must create an expectation that nonengineers/nonscientists will understand the technical facets of problems not just the 'issues.' Bringing the wisdom of the ages to modern problems is essential but it can no longer be done very easily without an understanding of some of the technical details of the modern age.

Faculty must realize that just as they must include philosophy and literature as the cultural component for the engineering or science student they must also include applied mathematics

and computer science for the non-technical student. The only decision for faculty members developing such courses will be to look at their disciplines and subject matter from outside their fields and determine how to best fit the new courses into the curriculum and what delivery method will best present the material to their students.

TECHNOLOGY:
An Essential Component of Today's College Education

The Curriculum The Delivery System

INTRODUCTION

"Technology in the classroom is not to transplant
a textbook to a computer and hype it up
with fancy graphics and sound"

Wm Francis Herlehy III
HCI International '93

Technology has become both a pervasive and permanent part of our society. Science has become an indispensable part of our modern culture. Educated men and women of today, no matter their discipline, must not only speak the language of their field but that of technology also; or, the humanities and social science, if engineering or science is their field. Technology holds a secure claim to being a discrete part of our culture. However, technological issues also have ethical, philosophical, and/or moral dimensions, which must be recognized and addressed (Marx, 1995). Today's college faculty, whether they realize it or not, have a 'real job' of preparation on their hands and will need a great deal of help if they are going to perform that job well.

Traditionally, it has been the engineer and the scientist who was perceived as needing broadening, probably because they were seen as being primary and essential to the emergence of technology. But, traditional, non-technical education also needs to be put under close scrutiny. The purpose of many of these fields of study has been to bring the wisdom of the ages to modern issues.

Those who cannot remember the past
are condemned to fulfill it.

George Santayana
The Life of Reason

This simply can no longer be done without understanding some of the technical details of the modern age. The idea that technical subjects such as scientific research, computer science, and applied mathematics need not, or cannot, be taught to non-technical students is every bit as erroneous as suggesting that engineering, science, or flight students cannot, or need not, be taught philosophy or literature. In fact, the only prerequisite in both cases is a desire to know and clearly understand what a subject is all about, to include its implications and ramifications in our technological society.

Now that it is clear that technology is a permanent and significant part of our culture, educators must come under close scrutiny. The ubiquitous computer, the overwhelming technical components of political issues, and the rising awareness of questions of risk and benefit have made technology the focus of new interest to educators--or it should be.

TECHNOLOGY IN THE CURRICULUM

There is so much confusion as to the mission of the college and university that it is no longer possible to be sure why a student should take any particular program of courses. Is the curriculum an invitation to broad intellectual and philosophical growth or exposure to the specific skills of a particular trade (AACC, 1995)? Or, is it some combination of both? Any degree of certainty that might have existed on such questions has all but disappeared during the last twenty-five to thirty years. The apparent void has invited programs fraught with transitory knowledge developed without any concern for the criteria of self-discovery, critical thinking, and the exploration of technology as it relates to the sought-after discipline. The curriculum structured to prepare students for the society and culture they are about to become an active part of has given way to a marketplace philosophy: it is the shelf in the grocery store where the student is the shopper and the faculty are the merchants. The demands of popularity and the success of enrollments become the driving force to the detriment of wisdom and experience. It is as if no one cared, as long as the store stays open.

Not all liberal-arts students would agree they need to understand anything about physics or nuclear energy to understand the political implications or ramifications of a 'Chernobyl' and neither would all engineering or flight students agree they need to know how to parse a sentence or where it was that Shakespeare wrote "brevity is the soul of wit.' Few technical problems are without their social, economic, moral, and aesthetic elements. As knowledge of the liberal arts broadens the experiences of the engineer or pilot, an understanding of technology broadens the experiences of a social scientist or philosopher.

Because of the computer, especially the personal computer, courses in technology need to fast become indispensable components of a college-level education. Stephen White wrote, "What the computer has done is provide scope for analytical skills that has never before existed, and in doing so has altered the world in which the student will live as well as the manner in which he (or she) will think about that world" (Marx,1995). Large, and not necessarily so large, computers can do anything from play war to model the universe and a considerable portion of what they can do is unintelligible without the fundamentals of technology and quantitative knowledge.

Decidedly new courses must be developed because courses characterized by a 'soft' approach to science and technology typified by such titles as "Poetry for Physicists" and "Computers for Social Scientists" will simply not suffice in today's world. Faculty members who develop such courses will have to look at their disciplines and subject matter from outside their fields and make decisions as to how these new courses will be integrated into the curriculum. It will not do simply to offer these courses. Faculty and administrators must encourage and, perhaps, ultimately require nonscientists, nonengineers, and liberal arts students to take an appropriate, specified number of courses in the quantitative areas, applied mathematics, and technology. The engineer, scientist, and pilot must likewise be encouraged and, if necessary, required to take those social science and humanities courses that address the social, moral, economic, and aesthetic elements of their respective technical disciplines.

Much of what Jacob Bronowski posited in his article entitled "The Educated Man in 1984" has not withstood the test of time. The 'orwellian' world he warned of has not come to be. However, his belief that most of the unique developments of the 20th century were technological and that they called for more science, applied mathematics, and quantitative studies in the classroom does hold up or, perhaps, even gains strength with the passage of time and through observation of the aftermath of current technological change. He suggested the absolute necessity of 'hard' courses that conveyed the essence of statistics, chemistry, biology, and computer sciences as the evolution of knowledge through the scientific method (Petroski, 1994). I join in his suggestion for this to be the core requirement of today's college curriculum. I also echo his call for every undergraduate to 'do one small piece of scientific research.'

Though I am not inclined to prescribe specific courses, there are certain learning experiences that are essential to the kind of education that will prepare the undergraduate as an individual and as a member of a society abound in technology. I will briefly discuss what I consider to be the most important of these.

We as a people neither understand nor exercise control over the technology we have unleashed. The technology has placed a man on the moon, given us acid rain, and put a computer on every desk in both the office and in the home. The technology continues to accelerate; the understanding and the control get further behind. If there is any validity to the notion that it is not possible to be comfortable in this technological world, educators have to share in some of the blame for this state of mind. Surely this world is less bewildering to someone who understands the nature of technology, its methods, its reliability, and its limitations. Technology is based on scientific truths. These scientific truths are subject to revision. Their revision is based on new knowledge and understandings. A person who understands what technology is recognizes that technical concepts are created by acts of human intelligence and imagination and comprehends the difference between observation and inference and between the occasional accidental discovery in technical investigation and the decisive strategy of scientific investigation: the forming and testing of hypotheses; the understanding of how theories are formed, tested, validated, and given provisional acceptance; and the distinction between conclusions that are based on unverified assertions and those that were developed from the application of empirical reasoning (Horn, 1994).

To be intellectually comfortable with technology is to understand the inherent limitations of scientific inquiry--to know the questions that empirical reasoning neither asks nor answers. A comprehensive understanding of technology REQUIRES an awareness of the ways in which technology has had a direct impact on intellectual history, one's own view of the universe, and one's view of the human condition. It also REQUIRES an awareness of how certain types of technological thought (empirical reasoning) inform and affect other disciplines such as history, economics, sociology, and political science (AACC, 1995). The understanding of technology just described is conspicuous in its absence among holders of a college degree.

Faculty can best assist students in understanding technology and its methods in a course that is not broad and infused with generalities but rather in a course where the subject matter is highly circumscribed. With skillful teaching, any problem or issue can be examined skeptically using the 'scientific method' to show relationships between data and conclusions, to suggest and evaluate hypotheses, and to design methods and procedures for careful examination of the problem or issue (Horn, 1994). Consideration of such methodology can in turn be used to raise philosophical questions about the nature of technology and the influence of political values and/or social setting on that technology. One invariably successful approach to the study of technology is an interdisciplinary perspective. Properly structured and taught interdisciplinary courses would focus on concepts and issues and satisfy the need, indeed requirement, for all college students to have a technical understanding of the world around them.

By demystifying technology with an emphasis on the social, political, and human implications of empirical reasoning, faculty empower their students with an understanding, a resiliency, and a sense of their own capacity to play a role in how the results of technology are used and will affect them. They will learn to observe, question, think of alternatives, and infer. They will catch on to the importance of paying attention with some appropriate combination of imagination and concentration.

Undoubtedly, suspension of judgment is an appropriate element of empirical reasoning. It allows researchers to proceed and postpone decisions until empirical evidence mandates it. But we do not live our 'real lives' in suspension of decisions. We must make real choices, assume responsibility for those choices, and be comfortable with our own behavior in responses to those choices. They must embody the values of a democratic society and fulfill the responsibilities of citizenship in that society. We must be equipped to be perceptive and informed critics of our society and become repositories of the values that make a civilized and humane society achievable.

Capstone courses in moral philosophy and theology as the source and definition of values have all but disappeared from college curricula. They have been replaced, in many cases, by so-called 'value-free' social science courses and 'objective' scientific/technical courses. Investigation into the sources of moral behavior and the nature of virtue were intended to lead one into the reasoning of human nature, the pursuit of goodness, and individual and social ethics. They instilled a reassuring sense of one's own fitness to play a role in the 'moral order.' While many of us subscribe to ethical concern and social responsibility they seem to have been shunted aside from the college curriculum. It appears that the only certain place in the curriculum where human values and character receive any attention are in the required ethics or philosophy course. There appears to be no other place where we develop and nurture the capacity to make informed choice and accept responsibility for that choice. This learning experience must be available to all students. We cannot avoid the necessity of preparing students for inquiry, choice, and judgment in the technological society we have created. The curricular opportunities are there. Unfortunately they are seldom seized by faculty who are so taken up with specialization and empirical reasoning that they miss the challenge, the difficult challenge, of bringing their students the humanistic aspect of their discipline, the values, choices, and judgments of their subject, and the perspectives that are beyond their parochial interests and capacity. Faculty with a personal and professional commitment to teaching is one way to focus course material on life, its qualities, its demands, its choices and their relationship to the technological society for which we are preparing them.

TECHNOLOGY IN THE DELIVERY SYSTEM

Put away those chalk boards and flip charts. Technology, as a training tool, is becoming cheaper and more accessible.

Management Review
February, 1995

The technological content needed in the curriculum that should be presented in today's college classroom calls for a compatible delivery system. And colleges and universities should be at the forefront of technology in that delivery system.

New employees hired fresh out of college are going to get their first taste of the 'real world' by *logging on*, *surfing the net*, and *interacting*. A recent report published by Andersen Consulting suggests they are not adequately prepared to do so. Business and Industry is not going to get into a philosophical debate with academia over where the responsibility for this shortcoming, and whether it is a shortcoming or not, lies. They know they are faced with a burgeoning technology, not the least of which is the computer, and they are not going to be, or remain, competitive with a workforce that has not been educated and/or trained in the ways of technology. The theories of technology are not enough. They need people in the workplace who have experienced technology. And technology is advancing so quickly that even those who have experienced it in the academic classroom are just 'less behind' than others when they enter the workplace.

Business and Industry and the U.S.military have shown their conviction and commitment to technology in the delivery system with collective budgets exceeding hundreds of millions of dollars. The United States Air Force's Air Education and Training Command educated/trained more than 260,000 people last year. They recently issued a press release, which included a statement that without the efficiency and quality in the classroom made possible by technology, their training accomplishments would have been impossible (Conti, 1995).

To the Air Education and Training Command, technology applied to delivery systems means video teletraining, video teleseminars, computer based instruction, computer aided instruction, full motion video, and full duplex speech with compressed digital video service. Telecommunication systems have been established to provide the capability for one-way video with two-way audio interactive links via satellite (Conti, 1995).

To Business and Industry, as indicated by eighty percent of the *Fortune 500* companies, technology applied to delivery systems means interactive multimedia training. IMT generally refers to computer-based learning that includes sound, video, graphics, animation, and text. Typically, it is delivered on a CD-ROM because of its huge storage capacity. Video and audio use up so much more storage space than text alone that the CD-ROMs become an ideal choice for multimedia (Marx, 1995).

Education and training are areas where the payback can be quite large. Interactive multimedia training is getting rave reviews from business, which are reporting improved learning and savings of millions of dollars. That once-elusive rate of return for training has become quite clear and definitive.

An appropriate question at this time and for this report is, 'What is academe doing?' It is my intention in concluding this report to address some of the key areas to consider when answering the suggested question.

Training without people?

Education and training have come to mean a classroom with an instructor. I am not going to suggest nor does anyone I know expect technology to wipe out the need for face-to-face classroom instruction. However, there are many teaching and learning tasks that are more effectively and more efficiently handled by technological tools. I am ready to suggest that for any needed learning experience that was previously dealt with, in whole or part, outside of the classroom, or not at all, because of a limiting resource, we reconsider the learning experience for the classroom using telecommunications and/or simulation to bring the resource, or a reasonable facsimile, to the student. There are customized simulations and made-to-order telecommunications programs along with new off-the-shelf simulations and programs that can tremendously increase the size and enhance the scope of almost any education or training program (Horn, 1994). Faculty and facilitators need only be limited by their imagination and creativity.

Example is the school of mankind,
and they will learn at no other.
Edmund Burke
On a Regicide Peace

Resources available?

No standards for quality or content currently exist for defining technological delivery systems so caution is of the essence in selecting or developing systems for any particular use. Transplanting a text to a computer and hyping it up with fancy graphics and sound is not putting technology in the delivery system. A key behind putting technology in the delivery system is to liberate learning from the 'linear tyranny' of a textbook where each chapter moves lockstep into the next. Technology in the delivery system is to have access to a 'huge encyclopedic wall full of textbooks'(Marx, 1995) and to be able to go right to the information that is needed and present it to the student in multiple ways, with sound, with video, and with graphics or animation. This on-line collection of learning resource materials is not only to be available to faculty but also to students. Technology in the delivery system is not only access to the library of learning resources but is also a system of providing instant feedback to a persons responses to instruction.

Taking advantage of computer technology allows students to zig zag through a course, taking a little bit from one section of a course outline and more from another in a fashion that allows them to customize a course, indeed a program, to accommodate their learning needs. It will let the faculty member, or the student, have either a cursory view or in-depth knowledge of a subject, depending on what the need is. A good example of this is simulation in the delivery system (Horn, 1994). The fundamental justification for including a simulation game in the delivery system is to allow faculty and students to continue using in the learning environment the very method they have used all of their lives to gain knowledge of themselves and others. Simulations can present a carefully designed framework of selected topics around which students will engage in activities that closely approximate the realities of what would otherwise be an inaccessible life situation.

With some planning, innovation, and strategic execution it is fairly easy to incorporate simulation into the college course. The point to be made is that simulation can offer a great deal to college faculty. Simulations offer an inexpensive and intriguing means for bringing issues alive in the learning environment. They allow for the examination of theoretical paradigms and their applicability to everyday situations. They offer a means of actively involving students in 'failure-proof decision making' and in analyzing the consequences of the process (Horn, 1994). Faculty will not have to rely on special-order materials or 'nerds' once a basic understanding of the simulation process is developed.

Flexible? Adaptable?

The best feature of technology in the delivery system is that it creates methods that easily adjust to students responses and reactions. Because the student tends to respond independently, they can be given feedback independently. However, technology in the delivery system is not the panacea for all teaching and learning concerns. Certain courses, requiring complicated judgments or those that benefit from peer interaction, are better left to the classroom and face-to-face interaction. A computer cannot duplicate the level of sophisticated interactions between a faculty member and a student where you find a question is followed by an answer which is immediately followed by another question and another answer. Where technology in the delivery system excels is in teaching fundamental aspects of a subject such as negotiation techniques, accounting analysis, process/results analysis, as well as procedures. What makes the technology especially appealing in the learning environment is that it makes teaching and learning relevant from the perspective that we are using technology to teach and learn about technology (Herlehy, 1993).

Example is always more
efficacious than precept.
Samuel Johnson
Rasselas

We can do things with technology driving the delivery system that we simply could not do before. We can simulate situation-specific environments so well that students will feel they are actually working the issue or problem. The net result is that students have deeper competencies, more skill, and more knowledge.

Perhaps the most valuable result of all
education is the ability to make
yourself do the thing you have to do,
when it ought to be done,
whether you like it or not.
Thomas Henry Huxley
Technical Education

In The Forefront?

Putting technology in the delivery system is a natural decision for the college and university. They already have some portion of the hardware that is needed. Many also have at least some of the multimedia capability to support it. Academia is equipped to take advantage of emerging technologies for the learning environment. They might get better equipped. They need to be willing to do it. Computers, interactive programs, simulations, etc. are the answers to providing a technically-oriented curriculum to prepare students for the technological explosion they are to face when they leave the university and to do it in the most effective and efficient fashion. It is the efficiency and effectiveness of technology in the delivery system that mandates it be used to keep up with the explosive growth of technology in our society.

Learning is for the future;
that is, the object of instruction
is to facilitate some form of behavior
after the instruction has been completed.
Robert F. Mager
Developing Attitude Toward Learning

REFERENCES

Association of American Colleges Committee, "Integrity in the College Classroom," The Chronicle of Higher Education, February, 1995.

Conti, Carl, "Air Education and Training Command," Intercom, January, 1995.

Herlehy, Wm. Francis, "A Study of Human-Computer Interaction" Human-Computer Interaction: Applications and Case Studies, Elsevier Science Publishers, New York, NY, 1993.

Horn, Robert E., "The Guide To Simulation For Education," Didatic Systems, Inc., Cranford, NJ

Marx, Wendy, "The New High-Tech Training," Management Review, February, 1995.

Petroski, Henry, "Point of View," The Chronicle of Higher Education, October, 1994.

CYBEREDUCATION:

EFFECTIVE INTERNET TEACHING TECHNIQUES FOR THE INFORMATION AGE

by

Marie J. Abram
Assistant Professor of Aviation Business Administration
Embry-Riddle Aeronautical University
College of Career Education, Sky Harbor Resident Center, Arizona

CYBEREDUCATION:
Effective Internet Teaching Techniques for the Information Age

By Dr. Marie J. Abram

INTRODUCTION

Cybereducation is not a word I have run across in my readings. It is a word I have constructed myself after exploring the Internet and reading widely in the Futuristic literature. In this paper I invite you to accompany me on a cyberjourney.

Before I begin the tour I ask your patience as I briefly review some popular works in Futurism. I believe this background is necessary to understand the enormity of the Information Revolution we are presently experiencing.

OUR CHANGING WORLD

Our planet is presently experiencing a mind crunching revolution. It affects the way we bank, the way we communicate, and the way we educate our young. It is so comprehensive that it is sometimes difficult to see and explain.

What is this revolution? It is called many things by many people -- but most often it is referred to as the Information Age. The engine of the Information Age is the computer -- complete with supporting telecommunication equipment.

Alvin Toffler wrote a series of books that describe this revolution. In 1970 he released Future Shock. In 1980 he followed up with The Third Wave. In 1990 he explained the changes in further depth in Powershift. These writings help us surf the Third Wave rather than get caught in its undertow.

John Naisbitt and Patricia Aburdeen wrote Megatrends (1980) and Megatrends 2000 (1990). Recently (1994) Naisbitt released Global Paradox. In this work he tells why the nation's telecommunications infrastructure will determine its place in history in the Twenty-First Century.

These authors agree that the well-educated citizen is increasingly important to American leadership and economic stability. Is it any wonder then that education is currently on the national agenda? Yet, even when education is doing very well by past standards it receives criticism. Why? In great part this criticism is leveled because new skills are needed for the new age. At present these new skills are poorly defined and the teaching/learning methods to accomplish the learning tasks are even less well defined. However, innovative educational projects abound due to creative individuals feeling their way into developing a new learning system. This paper will explore a portion of the search presently going on for a new teaching/learning methodology.

A UNITED STATE'S ANSWER: THE NII

Our national leaders looking outward ten and twenty years into the future have proposed the National Informational Infrastructure (NII) as a means of maintaining American leadership into the Twenty-First Century. Two Internet documents are useful in understanding the NII concept: The National Information Infrastructure: Agenda for Action (1994) and Benefits and Applications of the National Information Infrastructure (1994).

A third Internet document entitled Getting the NII to School: A Roadmap to Universal Participation (Beranek & Newman, 1993) discusses present plans for linking schools to NII. The present plan calls for all the nation's schools to have at least one device connected to the NII network by the end of 1996.

When the NII is complete businesses, government, average citizens, and non-profit institutions (of which our educational system is a part) will be linked through satellite, microwave, fiber optic cable and anything else that is useful in the transmission of information. The complete NII is not yet with us. However, the NII will subsume the Internet as presently fashioned (Roberts, 1994). By looking at current innovative educational projects taking place on the Internet we may be able to 'piece together' some understanding of Cybereducation as it will emerge in the Twenty-First Century.

METHODOLOGY

This paper overviews projects that are presently available on the Internet through Mosaic search capabilities. Consequently, if the reader has Mosaic available to them they are encouraged to READ the paper and simultaneously SEARCH Mosaic. All project Mosaic URL's (as of December, 1994) are listed in the reference section under the subtopic "Mosaic Linkages to Projects". (A URL is the mailbox address for Mosaic documents.) By both reading this paper and searching the Internet the reader can EXPERIENCE the new teaching methods. (This paper is also available as a Mosaic document. When using the Mosaic version the reader can just point and click to the project references and be immediately 'transported' to the projects.)

Our goal is to widely sample learning/teaching projects and examine the educational practices that 'make them work'. We cannot go everywhere or see everything on our journey. Consequently, we will narrow our focus in three ways. First, it will use Mosaic as our sole search tool. Secondly, we will narrow our focus to documents that describe current educational projects. Thirdly, we will focus only on projects conducted through institutions whose major function is education.

In total, our focus is to explore the learning/teaching practices that are emerging when learning is being conducted in the cybersphere. We will be guided by the theoretical work of Carol Twigg, Beverly Hunter, Robert Tinker, Roger Schank, and Chip Cleary.

THEORETICAL UNDERPINNINGS

Dr. Twigg is the Vice President of Educom a group of Higher Education institutions dedicated to exploring ways to make current technology more efficient and effective in education. Dr. Twigg (1994, 1994) calls for teaching students to learn how to learn which includes: critical thinking, quantitative reasoning, effective communication, search techniques, and working with others. She calls for individual learning in customized learner-centered environments. She asks for a mentoring format in which the mentor works with the individual student to help achieve that student's goal.

Dr. Beverly Hunter (1994), expresses her thoughts in 'Learning and Teaching on the Internet' on a learning/teaching technique she calls 'authentic education'. This type of education opens up the entire world as the base of knowledge to solve real-world problems by interdisciplinary projects. Students often work on the projects collaboratively with other students and with teachers. Students study in a Just-In-Time learning mode rather than follow a preset curriculum sequence and actively construct their own knowledge base rather than staying in lock step with their age mates. Dr. Hunter wants students to upload their work as well as download the work of others.

Dr. Robert F. Tinker (1993, 1993) is the Chief Science Officer of TERC. He is against the Industrial Revolutionary form of 'storehouse' education which he describes at atomisticly breaking down topics into studies then into lessons, etcetera. Instead he proposes a method of teacher support of learning that is interdisciplinary and integrative. He wants students to work on current problems using a hands-on and project based format. He wants students to select their project and have the freedom to work within their own learning style. This method does not require telecommunication. However, when telecommunication is added excitement is increased through worldwide collaboration with people unlike self, increased access to databases, and student dissemination to the world at large. He also encourages a pairing of university centers and schools.

Roger Schank and Chip Cleary (1994) are authors of the hyperbook, Engines for Education. Both gentlemen develop experimental learning projects for the Institute for Learning Sciences (ILS) at Northwestern University. They call for a teaching style that helps the student discover answers. They want teachers to help children muse and question while exploring a wide range of opinions. They call for teaching situations in which factual knowledge can be naturally acquired.

EXPLORING INTERNET PROJECTS

Fourteen projects are briefly described below. This paper focuses on the learning/teaching methods used in the projects rather than on the projects themselves. As explained above, it is the writer's desire for the reader to become actively engaged in exploring the database. She hopes this paper will facilitate an exploration of the database so readers can actively construct their own knowledge base defined by their own particular interest in the subject using their own particular learning style. The readers are encouraged to pose their own questions and discover their own answers and to consider the writer's opinion as but one of many possible opinions. The writer will feel successful if she has helped her readers muse and question.

(1) Arizona Mars K-12 Education Program Information.

This project began in 1992 as a means of disseminating the Mars Observer mission into the schools. When communication was lost with the Mars probe the project mission was expanded to teaching about the solar system in general. ASU/Mars is headquartered at Arizona State University. Funding is supplied by NASA. The project includes active dissemination of text, data, and graphics on the home page along with development and dissemination of support tools for the classroom. ASU/Mars holds semiannual training workshops for teachers.

The ASU/MARS cyberdocumentation is impressive. Special attention is called to solar pictures located at http://esterila.asu.edu/asu_tes/TES_Editor/dsn_solarsyst.html.

(2) Ask-A-Geologist

Beginning October 4, 1994, the U.S. Geological Survey Branch of Pacific Marine Geology is offering a free service to the schools. Children can e-mail their geological questions to ask-a-geologist@octopus.wr.usgs.gov and receive an answer in a day or two. After several months of fielding questions, USGS plans to post a FAQ document.

(3) Ask Dr. Math

"The Swat Team" of Swarthmore College will field math questions of K-12 students. The project is funded by the National Science Foundation. Questions can be e-mailed to dr.math@formum.swarthmore.edu.

(4) AT&T Learning Network

AT&T is involved in helping K through 12 teachers create virtual "Learning Circles" composed of geographically and culturally diverse classrooms. These Learning Circles are made up of seven to nine groups of students in different locations around the globe. Together they explore the same curriculum and communicate toll free via unlimited use of AT&T's Easy Link Service global network. Upon acceptance into a circle, classes introduce themselves to other components of the circle. The classes then design a project drawn from classroom curriculum developed by AT&T. The curricula materials are written to grade level. Much of the transmission time involves exchanging the work of students. The goal is for circles to put together a Circle publication of their collective work. Project can be in writing, mathematics, science, history and geography, social studies, and current global issues. A typical 6 week session costs the school $195.

(5) Big Sky Telegraph (BST)

BST is an on-line educational community network based in Wyoming. It is dedicated to supporting teleliteracy in rural America. BST provides free access to its bulletin board and free on-line lessons to the Internet. However, actual use of e-mail and full access to the Internet comes with a low fee.

One of BST projects is called Off-line Reader. In this project individual students subscribe to their own newsgroups. Through BST mediation software each student inserts their own disk into the school telecomputer and receives their own messages. Students then read the messages at their microcomputer workstation and compose return messages. Later in the day all students reinsert their disk. Messages are automatically uploaded to the discussion groups after midnight to obtain optimal phone rates. This method facilitates cybereducation where telecommunication equipment and budget are limited.

(6) The CoVis Project (Learning through Collaborative Visualization)

This project is devoted to teaching earth and environmental science to high school students using authentic scientific visualization tools. It specializes in electronic collaboration between high school students, university professors, and graduate students. Funding is supplied by the National Science Foundation and a host of businesses including Sony, Apple, and Sun Microsystems. Partners include The Exploratorium, Department of Atmospheric Sciences (University of Illinois), and Department of Electric Engineering (University of Michigan).

The project contains several unique components that support collaboration. One is the Cruiser videoconferencing that allows video conferencing between two individuals. A second is Timbuktu screen sharing which allows one individual to control the computer of another. A third is the Collaboratory Notebook, a groupware package designed for note taking and sharing. This package is designed to follow threads resulting from observations.

Collaboration connects high school students, university professors, and graduate students. During the 1993-1994 school year 118 students at six high schools piloted the program. High school students work on real and current problems with their mentors. CoVis is dedicated to teaching the collaborative scientific process just as much as it is dedicated to teaching science subjects.

(7) The Empire Internet Schoolhouse

The Empire Internet Schoolhouse is dedicated to serving K-12 students and educators by allowing them to explore the Internet. It uses a gopher menu to locate resources, connect to discussion groups, access New York State College admissions, and access e-mail. It encourages electronic fieldtrips to other schools. This project receives support from IBM, the New York State Science and Technology Foundation, and the National Science Foundation.

(8) Free Educational Electronic Mail Network (FrEdMail)

FrEdMail is the oldest educational network in America to provide schoolchildren a gateway to the Internet. It is free although users must pay the costs of linking to its nearest node. FrEdMail also sponsors projects that use the Internet. One project is devoted to improving writing via projects that give students something exciting to write about. For instance in the Acid Rain project students around the country collected rain samples. They shared the data and wrote research reports. In

Experts Speak some students dressed up as historical personalities and other students interviewed them to identify who they were. The funding source for FrEdMail is unknown.

(9) Foster Project

The Foster Project is directed to teaching science to elementary and middle school students. It is sponsored by the National Science Foundation and NASA through funds distributed to SETI (Search for ExtraTerrestrial Intelligence). Material located on the Foster Home Page describes the project as using a 'hands-on' approach to encourage students to learn in alternate ways through activities that encourage questions and provide opportunities to reinforce critical thinking.

Its current project is called Life in the Universe. The project has developed teachers' guides and student workbooks as well as slides and transparencies, videos, and posters. Modules include: The Science Detectives, Evolution of a Planetary System, How Might Life Evolve on Other Worlds?, The Rise of Intelligence and Culture, Life: Here? There? Elsewhere?, and Project Haystack.

(10) Internet HUNT

The Internet Hunt was created and still operates under the direction of Rick Gates at the University of Arizona. It challenges individual children or teams to scour the public domain sections of the Internet looking for answers to a wide variety of questions. Prizes are awarded. Twelve questions are asked; the first 11 count toward the scoring. Each question answered correctly receives from 1-10 points depending on its level of difficulty. Partial credit is awarded. These 11 questions have been verified by Rick Gates. The twelfth question is the mystery question and even Rick Gates does not know whether the Internet contains the answer. Separate winners are declared for individual players and for teams. Participants have one week to respond.

(11) Jason Project (JFE)

The Jason project is the brainchild of a famous scientist, Dr. Robert Ballard (who is the discover of the sunken R. M. S. Titanic). JFE's five year strategic plan calls for it to become the worldwide standard of excellence in interactive telepresence education. It wishes to be a powerful force in both the fields of education and 'edutainment'. The Jason Project is very expensive. The past and current sponsors list reads like a page out of Who's Who in American business. It also receives cooperation from public agencies such as the National Park Service and NASA.

The Jason Project takes students on interdisciplinary scientific expeditions around the world using interactive telepresence. Telepresence is using the latest in high technology to facilitate meaningful dialogue between scientists at the site and students in the classroom. Many techniques are used to accomplish telepresence. For instance, a current project will take students to and into volcano Pu'u'O'o via remote-controlled cameras.

Expeditions include: Island Earth, Planet Earth, The Sea of Cortez, The Galapagos Islands, Lake Ontario and the ships from the War of 1812, The

Mediterranean Sea, and Belize.

JFE produces curriculum material for classroom use including interactive CD-ROMs and video games. It also holds teacher training programs. It offers fellowships to a few students and teachers so they can accompany the scientific team on the various expeditions. Recently it has begun association with the Mind Extension University to create the JASON Classroom Network.

(12) KIDSLINK

Kidslink is non-profit organization based in Norway. It is devoted to linking children and classes together to promote global dialogue. In 1994 it involved over 23,000 children in 60 countries. Kidslink is designed for children between 10 and 15 years of age.

A current project is called What's in a Name. This project will help children appreciate the history, culture, language, literature, sociology, and mythology in people's names. Another project centers around the sunken steamship SSCA. Students will explore the wreck, the passengers and crew, and the hurricane that sank her. Yet a third project is called Math Penpals. Here students communicate data on weather, price of pizza, etc. Kidslink run primarily through volunteer staffing with volunteers making out-of-pocket contributions. Kidslink also actively solicits funds from businesses.

(13) School District's Home Page

The writer conducted a Lycos search using the words 'innovation' and 'schools'. This search uncovered a host of Mosaic Home Pages owned by school districts (and in some cases individual schools). One of the most extensive home pages is owned by the San Francisco school district.

The use of school district home pages as an administrative as well as an educational tool is very exciting to this writer. All the various publics of the district can have instant access to the majority of their information needs. Moreover, a major obstacle in giving students access to the Internet is controlled. This obstacle is limiting student's search to non-pornographic material. The writer prefers to reframe the problem and work toward making avenues for exploration that complement ongoing classroom studies so interesting that students will self-limit their time in recreational areas. District home pages also allow an avenue for dissemination of student work.

(14) S.E.D.S

S.E.D.S. stands for Students for the Exploration and Development of Space. It is dedicated to strengthening the space exploration program. S.E.D.S. operates as a collection of individual chapters around the world composed primarily of high school and university students. S.E.D.S. is headquartered at MIT. Much of each chapter's effort goes into learning about space exploration through speakers, tours, films, discussion groups, and linkages to daily NASA updates. Chapters also are involved in action projects, often hosting space exploration conferences in their community. Funding is not discussed.

CONCLUSIONS

Table 1 (see appendix) displays a chart the writer used to help determine whether a new style of learning/teaching is being used in the Internet projects. The rows represent the various projects and the columns represent the criteria suggested by our four theorists. A ratings scale from 0 to 3 was used to represent how much of a criteria was present (key is included in the table). The table represents the writer's estimations. Readers are encouraged to do their own estimations.

It appears that most projects rate high on the criteria of our theorists. This may well indicate that projects that succeed are projects that allow students to do something that is real world oriented, interdisciplinary, and collaborative. The projects reviewed appear designed to facilitate student's attainment of learning to learn skills because they require and support student's active construction of their own knowledge base. Most projects allow (even require) a sharing across cultures and levels of expertise. It would appear that students are gently guided to muse and question in the process of their studies. Consequently, it appears that our theorists have given sound advice regarding what is working well in 1994 as cybereducation takes its initial steps. Undoubtedly cybereducation will evolve further as it matures.

The following four questions are posed for the reader's consideration.

(1) Is it possible that the these programs are effective only with bright students?

(2) Can basic subjects as well as supplemental material be effectively taught this way?

(3) Is this new learning/teaching method cost effective?

(4) What components need to be added or subtracted to produce a viable cybereducation model for the Twenty-First Century.

REFERENCES

Hunter, Beverly. (1994). Learning and Teaching on the Internet: Contribution to Educational Reform. Educom Review. URL: gopher://copernicus.bbn.com:70/00/papers/pubaccess-Hunter.

Newman, Denis, Hunter, Beverly, & Bernstein, Susan. (1994). Getting the NII to School: A Roadmap to Universal Participation. URL: gopher://copernicus.bbn.com:70/00/testbed/Getting_the_NII_to_school.

Naisbitt, John. (1994). Global Paradox: The Bigger the World Economy, the More Powerful Its Smallest Players. New York: William Morrow and Company, Inc.

Naisbitt, John & Aburdeen, Patricia. (1990). Megatrends 2000: Ten New Directions for the 1990's. New York: William Morrow and Company, Inc.

Naisbitt, John . (1980). Megatrends. New York: William Morrow and Company, Inc.

Roberts, Michael M. (March/April 1994). Building the NII: Challenges for Higher Education. Educom Review. URLhttp://sunsite.unc.edu/nii/NII-Benefits-and-Applications.html.

Schank, Roger & Cleary, Chip. (1994). Engines for Education. URL:http://www.ils.nwu.edu/~e_for_e/nodes/I-M-Intro_ZOOMER-pg.html.

Tinker, Robert F. (Sept., 1993). Science for Kids: The Promise of Technology. URL: http://hub.terc.edu:70/0/hub/owner/TERC/chief_scientist/tech_and_science_ed.txt.

Tinker, Robert F. (Sept., 1993). Telecomputing as a Progressive Force in Education. URL:http://hub.terc.edu:70/0/hub/owner/TERC/chief_scientist/telecomputing.txt.

Toffler, Alvin. (1990). Powershift. New York: Bantam Books.

Toffler, Alvin. (1980). The Third Wave. New York: Bantam Books.

Toffler, Alvin. (1970). Future Shock. New York: Bantam Books.

Twigg, Carol A. (July/August, 1994). The Changing Definition of Learning. Educom Review.
URL: gopher://ivory.educom.edu/00educom.review.94/july.aug/Twigg_Article.

Twigg, Carol. (September/October, 1994). Prospectus for a Strategic Collaboration Facilitated by Educom. Educom, Review.
URL: http://educom.edu.review/review.94/jul.aug/Twigg_Article.

__________. (1994) . The National Information Infrastructure: Agenda for Action: Executive Summary. URL: http://www.sunsite.unc.edu/nii/NII-Executive Summary.html.

__________. (1994). Benefits and Applications of the National Information Infrastructure. URL: http://www.sunsite.unc.edu/nii/NII-Benefits-and-Applications.html.

Mosaic Linkages to Projects

Arizona Mars K-12 Education Program.
URL:http://esther.la.asu.edu/cgi-bin/imagemap/tes_home?146,330.

Ask-A-Geologist URL:
gopher://unix5.nused.gov/00/Education%20News/11-03-94%20Ask-aGeologist%20by%20E-Mail.

Ask Dr. Math URL: http://olmo.swarthmore.edu/dr-math/dr-math.html.

AT&T URL: gopher://digital.cosn.org/00/Resources%20on%20the
%20Network/Educational%20Projects/AT%20T.

Big Sky Telegraph
URL:gopher://digital.ocosn.org/00/Resources$20on%20%20the%20Newwork/Educational%20Projects/Big%20Sky.

CoVis URL: http://www.covis.nwu.edu/.

The Empire Internet Schoolhouse. URL: gopher://nysernet.org.3000/1.

Free Educational Electronic Mail Network (FrEdMail)
URL:gopher://digital.cosn.org/00/Resources%20on%20the%20Network/Educational%20Projects/FrEdMail.

Internet HUNT URL:gopher://gopher.cic.net/00/hunt/about/intro.txt.

The Jason Project.
URL: http://seawifs.gsfc.nasa.gov/JASON/HTML/JASON_HOME.html.

Kidslink URL: gopher://kids.duq.edu/1.

San Francisco School District's Home Page.
URL:http://nisus.sfusd.k12.ca.us.

S.E.D.S. (Students for the Exploration and Development of Space)
URL: gopher://bozo.lpl.arizona.edu/1.

APPENDIX

Table 1
Ratings of Cybersphere Projects

Project	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1. ASU/Mars	3	?	3	3	3	3	3	3	3	3	?	3			
2 Ask-a-Geo	3	N	N	?	3	3	3	3	N	3	1	3			
3 Ask Math	3	N	N	3	3	3	3	3	3	3	0	3			
4 AT&T	3	1	3	2	?	3	3	?	2	?	2	2			
5 BST	3	2	3	2	3	2	3	3	2	2	?	3			
6 CoVis	3	3	3	3	3	3	3	3	3	3	3	3			
7 EmpireSH	3	1	1	1	2	2	3	3	3	2	?	2			
8 FrEdMail	3	3	3	3	3	3	3	3	3	N	3	3			
9 Foster	3	?	3	3	3	?	3	?	3	3	?	?			
10 I-Hunt	3	N	3	3	3	3	N	3	3	N	N	3			
11 Jason	3	3	3	3	3	3	3	3	3	3	3	3			
12 Kidslink	3	3	3	3	3	3	3	3	3	N	3	3			
13 S.D.HP	3	N	N	N	3	N	3	3	3	2	3	3			
14 S.E.D.S.	3	3	3	3	3	3	3	3	3	3	N	3			

Key:
A Learning to Learn skills (critical thinking, quantitative reasoning, effective communication)
B Mentoring Process (working one-on-one; student setting individual goals; helping students muse and question)
C Project Centered (hands-on)
D Interdisciplinary and integrative
E Current and real-life problems
F Collaborative (student-to-student, student-to-mentor; possibility for cross culture collaboration)
G Discovery Learning (student actively constructing own database, student coming to own conclusions)
H Use of student's own learning style
I Access to wide variety of resources (databases, opinions of many, etc.)
J School linkages to universities, scientific labs, etc.

K Dissemination of students work (student's ability to upload as well as download)
L Intrinsic motivation (motivation from work not from meeting adult expectation and getting grades)

Rating Scale:
0 None
1 Low Use
2 Medium Use
3 High Use
N Not applicable
? Unknown

PERCEPTIONS ON THE DIFFERENCES BETWEEN THE SOCRATIC AND EXPERIENTIAL TEACHING METHODOLOGIES

by

Dr. Marian C. Schultz
Associate Professor of Management
The University of West Florida
Adjunct Associate Professor
College of Career Education, Eglin AFB Resident Center, Florida

Dr. James T. Schultz
Associate Professor of Aviation Business Administration
Embry-Riddle Aeronautical University
College of Career Education, Eglin AFB Resident Center, Florida

Dr. Stephen O'Brien
Professor of Aeronautical Science
Embry-Riddle Aeronautical University
College of Career Education, Eglin AFB Resident Center, Florida

Perceptions on the Differences Between the Socratic and Experiential Teaching Methodologies

Abstract

There are numerous technological advances which are readily available for us in the university classroom. While the use of computers, on-line data bases, video networking, etc. will serve to greatly enhance the understanding and dissemination of information to the students, the instructor must not neglect a fundamental necessity for any class - the delivery system. This research focused on two of the common delivery methodologies utilized in higher education, the Socratic and Experiential delivery systems. The research hypothesis stated that there will be a significant difference in the perceptions of students when evaluating the Socratic and Experiential teaching delivery methodologies. Students, especially at the graduate level, will perceive the need to become more involved in their educational experience. Because of this students will be significantly more receptive to the Experiential than the Socratic methology. The null hypothesis stated that there will be no significant differences in the perceptions of students when evaluating the Socratic and Experiential teaching delivery system when evaluated at the a=.05 level of significance. The results revealed the students significantly preferred the Experiential methodology when compared to the Socratic approach. The data revealed that 82.5% favored the Experiential methodology, while only 17.5% favored the Socratic approach. While the results of the Chi Square tests supported the research hypothesis, it should not be assumed that the Socratic methodology is not a useful highly successful delivery system. However for these particular courses, which were highly behavioral in design and content, the Experiential approach, as perceived by the students was significantly favored over the Socratic method.

Perceptions on the Differences Between the Socratic and Experiential Teaching Methodologies

There are numerous technological advances which are readily available for use in the university classroom. While the use of computers, on-line data bases, video networking, etc. will serve to greatly enhance the understanding and dissemination of information to the students, the instructor must not neglect a fundamental necessity for any class - the delivery system. This research focuses on two of the common delivery methodologies utilized in higher education, the Socratic and Experiential delivery systems.

The Socratic Methodology

Prior to the Fifth Century BC, education was available solely to that strata of society that enjoyed wealth. The curriculum included subjects focused upon developing good tastes, judgement, and "...suitable moral qualities" (Lewis, 1965, p. 1). The Athenians considered the entire city their school, and everything they encountered was seen as an opportunity for learning.

The city-state was the dominant political entity and Athens was considered to be the most influential. The city was stratified with an aristocratic ruling class. As an extension of the divine right of kings, the aristocrats were believed to have inherent tendencies for good judgement and high moral qualities. During the Fifty Century, democracy became the prevailing form of government. The resulting expansion of commerce subsequently gave rise to a well-to-do middle class. So emerged a new class of society that had both the time and the resources to take advantage of educational opportunities. The proud Athenian citizens considered the preparation for the participation in self-governance a high priority.

This new affluent class sought training in public speaking and the art of argumentation (Lewis, 1965). This education demand was filled by teachers called sophists who focused on the dimensions of argumentation and rhetoric. The course of study was based on the belief that the ordinary Athenian citizen needed to catch up with the Aristocrats' God-given abilities. Protagoras, a well-known sophist, was noted as saying:
...The student would...only learn what he has come to learn. What is that subject? The proper care of his personal affairs, so that he may best manage his own household, and also the State's affairs, so as to become a real power in the city, both as speaker and man of action. (Lewis, 1965, p. 1)

By contrast, Socrates taught for the sake of the educational process itself. Along with Plato and Aristotle, he sought to develop the desire to pursue education as a life-long endeavor (Klein, 1993). Education was undertaken for more than the sole purpose of learning specific skills applicable to a particular career field, and then dismissed once that demand had been met. Socrates advocated the never-ending search for self-knowledge--the continual process of searching for the limits of one's knowledge and abilities.

Socrates developed a unique individualized method of instruction used to assist his students in teaching themselves. This methodology was based on the idea that the student learns best what he learns himself. The teacher's role in the learning process is to encourage the student to seek the answers to the question they may have, rather than to simply depend on the transference of information. The Socratic method, with its continued line of questioning, would not rely on simple yes/no or descriptive type answers. It often leads to the break down of the self confident, proud student with the self revelation of ignorance or limited knowledge. When awareness of their ignorance occurs knowledge is allowed to begin. He was noted with the following remark: "Philosophy begins in wonder...and wonder only comes when one has an awareness of his own ignorance" (Lewis, 1965, p. 3).

Upon discovering that his friend Hippocrates was eager to go to Protagoras for instruction, Socrates engaged his friend in a line of questioning. His motive was neither to humiliate, nor to discourage Hippocrates from seeking education from Protagoras. He simply wanted his friend to fully understand his intentions. Socrates asked him to explain the urgency in paying Protagoras for education. Unable to provide a sufficient explanation for his action, Hippocrates gained awareness thereby achieving self-knowledge. This situation illustrates the Socratic methodology which was intended for students.

Arete, Greek for virtue or excellence, was a subject that Protagoras claimed he could teach to his students. The point of contention was whether arete could be taught at all. Initially, Socrates did not believe the concept could be taught. Under irritating and intense interrogation (Socratic method), Protagoras eventually comes to the realization that he is unable to instruct on the subject of arete because it is not possible to fully understand the concept of arete itself. His self-knowledge was achieved through the questions that focused on its explanation. Surprisingly, Socrates' position on the subject was also altered by this line of questioning. He realized that arete was a knowledge that could be taught, but that qualified teachers were unavailable to teach it in Athens (Eisele, 1990).

His method of instruction was an invaluable tool, in his opinion, for gaining introspection that ultimately led to knowledge. The Socratic method urges students to look beyond the surface of a thought, principle, or theory. The line of inquiry that a teacher directs toward a student is meant to engage students in a deeper analysis of the subject matter. The student is forced to dissect the subject and seek to understand the core of the material. Moreover, Socratic methodology places students into a situation where they become aware of their subject ignorance. In so doing, the learning experience goes beyond mere definition of the subject, and extends to application and implication analysis. This indepth analysis is essential in order to develop critical thinking skills.

The Experiential Methodology

The experiential methodology can be seen as a reactionary movement to compensate for the institutionalized standard of the lecture format of instruction. In fact, it suggests that the group discussion format is less than optimal. The experiential model entails taking students either prior to, or immediately after being exposed to particular subject matter and having them test the theories, principles, and hypotheses through simulations or in the real-world environment. In other words, the experiential methodology does not completely dismiss the lecture and "hands-on" experience in properly developing the knowledge and abilities of students.

This instructional approach is by no means a recent development. It has been asserted for years that learning through experience is the most effective strategy. There have been technological developments over the recent past that have made experiential instruction even more applicable. Specifically, the use of computers and multi-media have made it easier for teachers to use real-world simulations to enhance the learning environment.

Computer Assisted Instruction (CAI) is an early generation technologically-based learning system. The potential is there to develop this system into one that offers a dynamic complement to the programmed readings and class lectures. CAI could vary its method of instruction from a basic transfer of information (such a text alone or text followed by quiz, known as the Branching Programmed Instruction Model), to a method that includes simulations or real-world phenomena, allowing students to manipulate variables and then analyze the repercussions of such changes (the experiential Model). The latter has been the most recent development in the use of CAI and ITS (intelligent tutoring systems). The Branching Programmed Instruction Model does nothing more than to try and replace the teacher in lectures, and is therefore not an advancement of the instructional technique. If the computer is going to be used, it should complement rather than substitute for classroom experience.

The type of textbook information that these tutorials are focused to convey are structural or static in nature. Theories, principles, and experiments are all presented in the tutorials, without an opportunity for the student to manipulate the variables within them to obtain a fuller understanding a process is required (Merril, 1994). The use of tutorials is maximized when it is used in combination with a more important areas. It is also appropriate as a focusing attention in the more important. It is also appropriate as a means of providing remedial instruction, due to misunderstandings emerging after the use of experiential techniques. Although tutorials are not ideal, they are effective when used properly.

By comparison with the static tutorial techniques, the experiential instruction model is responsive. The student is provided the opportunity to experience hands-on training of the material they have read or received in lectures. The advent of computer aided instruction makes this type of learning economically advantageous. The alternatives of maintaining the less optimal, but affordable, educational techniques or incurring excessive appears to provide students with real-world experience appears to provide a less than desirable outcome. Beyond the cost of real-world experience, it is impossible for someone to control the environment to such an extent that the manipulation of particular variables could be attributed to a sole criteria. Computer simulations provide users with the ability to accomplish this manipulative strategy. Students could learn about theories and principles through readings or lectures, then test them utilizing simulations (McQuillen, 1992). Only the self-imposed limits of the student's interest and imagination will restrict the depth of understanding that could be achieved through the use of simulations.

Lee and Cafarella (1994) established that there were guideposts for experiential instructional activities that must be considered when developing this type of learning environment. First, it must be understood that the knowledge is not unfamiliar to an individual, rather it is a synthesis of past knowledge with new experiences. Second, there is a shift in responsibility from the teacher to the student. Finally, the ability to transfer knowledge from the learning environment to real-world application is contingent upon the degree of similarity between the two, and the degree of depth and detail provided in the academic environment (Lee, 1994).

These guideposts are just the beginning of the process. The teacher and academic institution must decide how to best implement the education program, while adhering to these parameters. The program must achieve a balance between the academic portion and the field-based portion of the learning environment. In addition to classroom learning, "academics" refers to projects that may support the application of learning material. Experiential learning must provide students with the ability to take "what is learning", and apply it to particular skills or competencies in the real-world. The Experiential method must ensure that this acquisition of proficiencies is an aspect of an overall growth in knowledge experienced by a student. It is difficult to coordinate a curriculum which permits students to determine their specific courses and complementary field-based activities without faculty intervention. Direction must be provided to make certain that a student sustains an appropriate pattern of growth.

The Experiential model provides the most effective means of teaching students skills and competencies. This can be seen in contrast to the Socratic methodology which hopes to lead students into self-awareness necessary for further learning. While not all encompassing, each teaching methodology is appropriate in particular circumstances. In combination they are an outstanding method of embodying students with the thirst to seek continued knowledge, and acquire certain skills that could be applied to their intended profession. In terms of trying to reverse the trend of decreasing quality in graduates, the Experiential model is more appropriate in that it will develop student learning skills, while pursuing long term growth in the processing of student knowledge. Socratic methodology, while insufficient in providing students with applicable skills for their chosen profession, is valuable in that critical students with real-world experience appears to provide a less than desirable outcome. Beyond the cost of real-world experience, it is impossible for someone to control the environment to such an extent that the manipulation of particular variables could be attributed to a sole criteria. Computer simulations provide users with the ability to accomplish this manipulative strategy. Students could learn about theories and principles through readings or lectures, then test them utilizing simulations (McQuillen, 1992). Only the self-imposed limits of the student's interest and imagination will restrict the depth of understanding that could be achieved through the use of simulations.

Lee and Cafarella (1994) established that there were guideposts for experiential instructional activities that must be considered when developing this type of learning environment. First, it must be understood that the knowledge is not unfamiliar to an individual, rather it is a synthesis of past knowledge with new experiences. Second, there is a shift in responsibility from the teacher to the student. Finally, the ability to transfer knowledge from the learning environment to real-world application is contingent upon the degree of similarity between the two, and the degree of depth and detail provided in the academic environment (Lee, 1994).

These guideposts are just the beginning of the process. The teacher and academic institution must decide how to best implement the education program, while adhering to these parameters. The program must achieve a balance between the academic portion and the field-based portion of the learning environment. In addition to classroom learning, "academics" refers to projects that may support the application of learning material. Experiential learning must provide students with the ability to take "what is learning", and apply it to particular skills or competencies in the real-world. The Experiential method must ensure that this acquisition of proficiencies is an aspect of an overall growth in knowledge experienced by a student. It is difficult to coordinate a curriculum which permits students to determine their specific courses and complementary field-based activities without faculty intervention. Direction must be provided to make certain that a student sustains an appropriate pattern of growth.

The Experiential model provides the most effective means of teaching students skills and competencies. This can be seen in contrast to the Socratic methodology which hopes to lead students into self-awareness necessary for further learning. While not all encompassing, each teaching methodology is appropriate in particular circumstances. In combination they are an outstanding method of embodying students with the thirst to seek continued knowledge, and acquire certain skills that could be applied to their intended profession. In terms of trying to reverse the trend of decreasing quality in graduates, the Experiential model is more appropriate in that it will develop student learning skills, while pursuing long term growth in the processing of student knowledge. Socratic methodology, while insufficient in providing students with applicable skills for their chosen profession, is valuable in that critical thinking is developed.

Research Design

The research hypothesis for this study states that there is a significant difference in the perceptions of students when evaluating the Socratic and Experiential teaching delivery methodologies. Changes in society are directly reflected in our educational system. Formality in some instances, has given way to informality. Students, especially at the graduate level, will perceive the need to become directly involved in their educational experience. This need to interact with the educational experience suggests that students will be significantly more receptive to the Experiential than the Socratic methodology. The null hypothesis states that there will be significant difference in the perceptions of students when evaluative the Socratic and Experiential teaching delivery systems at the a=.05 level of significance.

To test this hypothesis, graduate students enrolled in classes at the University of West Florida (UWF) and Embry-Riddle Aeronautical University (ERAU) were surveyed as to their perceptions pertaining to the use of the Socratic and Experiential methodologies. Students in this research were enrolled in the University of West Florida's Master of Business Administration courses MAN 6156 (Organizational Behavior) Man 5105 (Management and Womens' Issues), and Embry-Riddle Aeronautical University's Master of Aviation Business Administration courses ABA 513 (Human Resources Management) and ABA 520 (Organizational Behavior). The number of students participating in this study from the University of West Florida was 229, compared with 147 from Embry-Riddle Aeronautical University. Students were instructed utilizing one methodology for the first half of the course, (University of West Florida courses are 16 weeks in duration compared to nine weeks for the Embry-Riddle term), and after the midpoint of the course the other methodology was implemented.

At the midpoint of the class, the students were surveyed as to their perception on the methodology utilized (Appendix A). At the end of the course the students were once again surveyed, utilizing the identical questions which had been asked at the midpoint of the course, along with an additional question asking them to identify which of the two methodologies they preferred (Appendix B).

To ensure that no significant differences existed between the West Florida and Embry-Riddle responses, a two-dimensional Chi Square test was utilized to compare the data for questions 1-6 in the survey. The responses for the questions evaluating the Socratic methodology were compared between the two groups, as were those for the Experiential approach. Utilizing 4 degrees of freedom (df) and a significance level of a =.05, a value equal to or in excess of 9.488 was necessary to reject the null hypothesis. The Chi Square results revealed no significant difference exists between the two groups for any of the six questions (Figures 1-6).

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	73.000	68.809	0.255
1	2	53.000	54.734	0.055
1	3	11.000	12.120	0.103
1	4	6.000	7.037	0.153
1	5	4.000	4.301	0.021
2	1	103.000	107.191	0.164
2	2	87.000	85.266	0.035
2	3	20.000	18.880	0.066
2	4	12.000	10.963	0.098
2	5	7.000	6.699	0.013

Complex Chi Square	
Statistic	Value
Chi Square	0.965
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 1. UWF and ERAU responses to question 1.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	80.000	77.000	0.177
1	2	52.000	51.333	0.009
1	3	8.000	7.000	0.143
1	4	5.000	7.778	0.992
1	5	2.000	3.889	0.917
2	1	118.000	121.000	0.074
2	2	80.000	80.667	0.006
2	3	10.000	11.000	0.091
2	4	15.000	12.222	0.631
2	5	8.000	6.111	0.584

Complex Chi Square	
Statistic	Value
Chi Square	3.564
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 2. UWF and ERAU responses to question 2.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	83.000	79.364	0.167
1	2	53.000	51.215	0.062
1	3	5.000	8.210	1.255
1	4	4.000	5.082	0.231
1	5	2.000	3.128	0.407
2	1	120.000	123.636	0.107
2	2	78.000	79.785	0.040
2	3	16.000	12.790	0.806
2	4	9.000	7.918	0.148
2	5	6.000	4.872	0.261

Complex Chi Square	
Statistic	Value
Chi Square	3.482
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 3. UWF and ERAU responses to question 3.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	87.000	82.101	0.292
1	2	50.000	50.434	0.004
1	3	5.000	7.428	0.794
1	4	3.000	5.082	0.853
1	5	2.000	1.955	0.001
2	1	123.000	127.899	0.188
2	2	79.000	78.566	0.002
2	3	14.000	11.572	0.510
2	4	10.000	7.918	0.548
2	5	3.000	3.045	0.001

Complex Chi Square	
Statistic	Value
Chi Square	3.192
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 4. UWF and ERAU responses to question 4.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	80.000	72.223	0.835
1	2	51.000	57.316	0.696
1	3	10.000	11.777	0.268
1	4	4.000	3.533	0.062
1	5	3.000	3.141	0.006
2	1	104.000	111.767	0.540
2	2	95.000	88.684	0.450
2	3	20.000	18.223	0.173
2	4	5.000	5.467	0.040
2	5	5.000	4.859	0.004

Complex Chi Square	
Statistic	Value
Chi Square	3.074
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 5. UWF and ERAU responses to question 5.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	79.000	71.154	0.865
1	2	56.000	60.598	0.349
1	3	9.000	10.556	0.229
1	4	2.000	2.737	0.198
1	5	1.000	1.955	0.466
2	1	103.000	110.846	0.555
2	2	99.000	94.402	0.224
2	3	18.000	16.444	0.147
2	4	5.000	4.263	0.127
2	5	4.000	3.045	0.299

Complex Chi Square	
Statistic	Value
Chi Square	3.461
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 6. UWF and ERAU responses to question 6.

The two-dimensional Chi Square test was then utilized to analyze the combined responses of the two groups to the questions comparing the Socratic and the Experiential methodologies (Figures 7-12). To ensure that the segment of the course in which the methodology was utilized, i.e., before or after the midpoint of the course, did not affect the results, the methodologies were randomly alternated. A value exceeding 9.488, utilizing 4 degrees of freedom with a significance level of @ = .05, was necessary to reject the null hypothesis. The data from the Chi Square tests revealed significant differences for each of the six questions, thus rejecting the null hypothesis. The results revealed the students significantly preferred the Experiential methodology over the Socratic approach. This was also apparent when analyzing the data from the question in the second survey which asked the students to select the methodology they favored. The results revealed that 82.5% favored the Experiential methodology, while only 17.5% favored the Socratic approach. A one directional Chi Square test was utilized to analyze significance (Figure 13).

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	40.000	120.500	53.778
1	2	37.000	64.500	11.725
1	3	10.000	10.500	0.024
1	4	101.000	66.000	18.561
1	5	188.00	114.500	47.181
2	1	201.000	120.500	53.778
2	2	92.000	64.500	11.725
2	3	11.000	10.500	0.024
2	4	31.000	66.000	18.561
2	5	41.000	114.500	47.181

Complex Chi Square	
Statistic	Value
Chi Square	262.537
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 7. Socratic verses Experiential responses to question 1.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	45.000	125.242	51.411
1	2	32.000	59.196	12.495
1	3	15.000	27.397	5.609
1	4	132.000	84.636	26.505
1	5	162.000	89.529	58.664
2	1	211.000	130.758	49.242
2	2	89.000	61.804	11.968
2	3	41.000	28.603	5.373
2	4	41.000	88.364	25.387
2	5	21.000	93.471	56.189

Complex Chi Square	
Statistic	Value
Chi Square	302.844
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 8. Socratic verses Experiential responses to question 2.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	33.000	115.500	58.929
1	2	48.000	69.000	6.391
1	3	5.000	9.500	2.132
1	4	140.000	92.000	25.043
1	5	150.000	90.000	40.000
2	1	198.000	115.500	58.929
2	2	90.000	69.000	6.391
2	3	14.000	9.500	2.132
2	4	44.000	92.000	25.043
2	5	30.000	90.000	40.000

Complex Chi Square	
Statistic	Value
Chi Square	264.990
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 9. Socratic verses Experiential responses to question 3.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	30.000	115.194	63.007
1	2	42.000	66.822	9.221
1	3	11.000	10.971	0.000
1	4	133.000	87.767	23.313
1	5	160.000	95.247	44.022
2	1	201.000	115.806	62.673
2	2	92.000	67.178	9.172
2	3	11.000	11.029	0.000
2	4	43.000	88.233	23.189
2	5	31.000	95.753	43.790

Complex Chi Square	
Statistic	Value
Chi Square	278.386
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 10. Socratic verses Experiential responses to question 4.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	33.000	118.959	62.113
1	2	38.000	62.194	9.412
1	3	11.000	10.366	0.039
1	4	152.000	92.304	38.607
1	5	152.000	102.176	24.295
2	1	208.000	122.041	60.545
2	2	88.000	63.806	9.174
2	3	10.000	10.634	0.038
2	4	35.000	94.696	37.632
2	5	55.000	104.824	23.682

Complex Chi Square	
Statistic	Value
Chi Square	265.536
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 11. Socratic verses Experiential responses to question 5.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	28.000	122.000	72.426
1	2	40.000	67.000	10.881
1	3	9.000	8.000	0.125
1	4	145.000	90.000	33.611
1	5	154.000	89.000	47.472
2	1	216.000	122.000	72.426
2	2	94.000	67.000	10.881
2	3	7.000	8.000	0.125
2	4	35.000	90.000	33.611
2	5	24.000	89.000	47.472

Complex Chi Square	
Statistic	Value
Chi Square	329.030
Rows	2
Columns	5
Degrees of Freedom = (R - 1)(C - 1)	= (2 - 1) (5 - 1) = 4

Figure 12. Socratic verses Experiential responses to question 6.

Cell Chi Square Values				
Row	Column	Observed	Expected	Chi Square
1	1	65.000	188.000	80.473
1	2	311.000	188.000	80.473

One Dimensional Chi Square	
Statistic	Value
Chi Square	160.947
Rows	1
Columns	2
Degrees of Freedom = (C - 1)	= (2 - 1) = 1

Figure 13. Socratic verses Experiential responses to question 7.

The results of the Chi Square tests supported the research hypothesis which purported that the Experiential methodology would be preferred over the Socratic approach. The authors perceived that the students would favor the Experiential method since this approach would directly involve the students in an interactive, "real life" scenario environment, versus the highly confrontational approach utilized in the Socratic methodology. This is not to say that the Socratic methodology is not a useful and highly successful delivery system. However, for these particular courses which were highly behavioral in design and content, the Experiential approach, as perceived by the students, is significantly favored over the Socratic method.

A Survey of Teaching Methodologies

The following survey is being conducted by Dr. Marian Schultz (904-897-3727). of the University of West Florida in order to evaluate the perceived differences between the use of the Socratic and Experiential teaching methodologies. Participation is voluntary, and all responses will be kept confidential. Thank you for your participation in this research.

University:____________________
Course:________________________
Semester/Term:_________________

The teaching methodology utilized prior to the midterm in this class proved to be an excellent way of providing information to the students.

Strongly Agree Agree No Opinion Disagree Strongly Disagree

The teaching methodology utilized prior to the midterm in this class provided an excellent way of learning the subject matter of the course.

Strongly Agree Agree No Opinion Disagree Strongly Disagree

If given the option, I would prefer the teaching methodology utilized prior to the midterm of this class in lieu of any other which I have experienced in prior classes at the college/university level.

Strongly Agree Agree No Opinion Disagree Strongly Disagree

The teaching methodology utilized prior to the midterm in this class caused me to become highly involved in the learning process (i.e. keeping up with the weekly assignments).

Strongly Agree Agree No Opinion Disagree Strongly Disagree

The teaching methodology utilized prior to the midterm of this class caused the students in the class to become highly involved in the learning process.

Strongly Agree Agree No Opinion Disagree Strongly Disagree

I thoroughly enjoyed the teaching method utilized prior to the midterm in this class.

Strongly Agree Agree No Opinion Disagree Strongly Disagree

Appendix B

Sample Survey Utilized After the Midpoint of the Class

A Survey of Teaching Methodologies

The following survey is being conducted by Dr. Marian Schultz (904-897-3727) of the University of West Florida in order to evaluate the perceived differences between the use of the Socratic and Experiential teaching methodologies. Participation is voluntary, and all responses will be kept confidential. Thank you for your participation in this research.

University:____________________
Course:________________________
Semester/Term:_________________

The teaching methodology utilized after the midterm in this class proved to be an excellent way of providing information to the students.

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

The teaching methodology utilized after the midterm in this class provided an excellent way of learning the subject matter of the course.

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

If given the option, I would prefer the teaching methodology utilized after the midterm of this class in lieu of any other which I have experienced in prior classes at the college/university level.

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

The teaching methodology utilized after the midterm in this class caused me to become highly involved in the learning process (i.e. keeping up with the weekly assignments).

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

The teaching methodology utilized after the midterm of this class caused the students in the class to become highly involved in the learning process.

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

I thoroughly enjoyed the teaching method utilized after the midterm in this class.

Strongly Agree   Agree   No Opinion   Disagree   Strongly Disagree

If given the option, I would select:

___ The teaching methodology utilized prior to the midterm of the class.

___ The teaching methodology utilized after the midterm of the class.

References

Eisele, T. D. (Fall, 1990). Must virtue be taught? Modern Age, p. 235

Klein, S. (Winter, 1993). Drucker's knowledge society and Socratic sophhrosyn Business and Professional Ethics Journal, 12, p. 52.

Lee, P. & Cafarella, R. (Summer, 1994). Methods and techniques for engaging learners in experiential learning activities. New Directions for Adult and Continuing Education. pp. 43-54.

Lewis, R. (1965). The philosophical roots of lifelong learning. pp. 1-3. Toledo, OH: Toledo University, Ohio Center for the Study of Higher Education.

McQuillen, J. & Ivy, D. (1987). Simulations: addressing competence and performance. Education, p. 72.

Merrill, M. D. (July 1988). Educational Technology. pg. 9.

PROPOSED IMPROVEMENTS IN COLLEGIATE AVIATION EDUCATION

By
Robert M. Kuhns, Ed. D.
Adjunct Assistant Professor
Embry-Riddle Aeronautical University
McConnell AFB Resident Center, Wichita, Kansas

March, 1995

Abstract

This paper presents findings related to proposed improvements in four-year aviation education programs as indicated by nation-wide survey instruments conducted in summer of 1993. Aviation education programs directors of four-year non-engineering collegiate aviation programs were contacted to provide input as to methods of improving the quality of aviation education programs. Key information obtained was then paraphrased into a written instrument that was categorized in order of importance by the program directors.

The improvement of both faculty and facilities and to provide more student internships were the most recommended improvements in this study. This paper provides multiple nationwide-ranked proposed improvements in aviation education, and describes peer-suggested methods of improving student attainment of knowledge, competency, and proficiency in aviation education.

Proposed Improvements in Collegiate Aviation Education

by Robert M. Kuhns, Ed. D.

Data were collected in the summer of 1993 to ascertain the perceived quality of four-year and higher aviation education programs throughout the nation. The following information was part of the author's doctoral thesis in which a multitude of information was acquired. This information was obtained from program coordinators, department heads, or similar individuals at the various institutions throughout the United States (N=68). A copy of the telephone interview questionnaire is found in Appendix A. Objective and subjective data were obtained from program directors in this study. Demographics as well as opinions were acquired. Key factors concerning aviation education were then organized into a second instrument. Aviation department heads were mailed the instrument and asked to rank in importance the various key factors. This instrument is found in Appendix B.

The University Aviation Association membership list was used to identify four-year and higher non-engineering aviation education programs offered in the United States. Aviation programs less then four years were not considered in this study. The UAA April 1992 Membership List contained the names of 106 member institutions of which 68 were found by the survey to offer four-year and greater aviation programs. (University Aviation Association, 1992). In the process of calling all 106 member institutions an updated number (68) of institutions that offer four year and higher aviation education programs was obtained.

The first questionnaire requested information of both a quantitative nature and a subjective nature. Student number, faculty demographics, future educational plans, aviation equipment and facilities, intra state student accessibility, and student recruiting were surveyed. More difficult questions were asked of the program\department chairs in which program quality, ranking against a national norm, current program status, factors contributing to quality aviation education, and which institution was considered to offer the best aviation education program in the United States.

The second questionnaire asked aviation program directors to rank key quality factors from most important to least important. These key factors were obtained from the most frequent responses in the telephone interview questionnaire.

Operational Procedures

All of the 68 identified member institutions were contacted by phone to conduct a structured phone interview. Confidentiality was assured to all participants. All institutions were contacted a minimum of four times to maximize responses. If a program director was unable to respond after four attempts, the institution was deleted from the survey. This was strictly random with no bias on the part of the telephone interviewer.

A telephone questionnaire technique allowed subjects to be more open in their responses, and if needed to ask for clarification concerning questions. The telephone technique also encouraged more detailed responses and provided for greater participation than mailed format questionnaires. This procedure may be considered successful if it has greater than the success rate accepted by research authorities of 55% (Perry, 1988).

The telephone questionnaire was written and submitted for evaluation to the researcher's doctoral committee. The recommended changes were then incorporated into a second draft, then it was presented to experts in questionnaire design, and modifications were adopted. The questionnaire was also presented to experts in English and Grammar at Wichita State University, Next it was presented to several program directors at member institutions for input. Finally the final draft was again presented to the doctoral committee. A small pilot group was then selected and a phone interview was conducted. After several interviews small changes were adapted to clarify and to improve understanding of the questionnaire. One additional question was also added (number 21) as per suggestion of a member of the pilot group. The second (written) instrument underwent a similar process and was approved by the doctoral committee before it was mailed.

The pilot group consisted of a former director of an aviation education program, a member of a nationwide aviation study, and several of the doctoral committee members. The revised final drafts were then presented to the researcher's committee chairman for final approval. Developmental and validation processes were then completed for this instrument.

Research Design and Analysis

The findings of this study, drawing on its qualitative and quantitative data, are presented in a descriptive design. Findings included program age, curriculum offered, future curricular plans, faculty demographics, equipment and aviation facilities, student recruitment, CAA membership, and follow-up of graduates. This information although obtained will not be presented in this paper. Subjective responses recorded on aviation program quality, factors that constitute a high quality aviation education program, and methods of improving quality of aviation education will be presented in this paper. Findings were organized in a descriptive and summarizing format to assure confidentiality to all participants.

Factors Contributing to the
Quality of Aviation Education

One question asked of program directors in this survey was what factors did they feel constitute a good aviation program. The question was completely open ended. For brevity similar responses were combined. The following, in order of number of times mentioned, is listed on the next page:

<u>Factors Associated with the Quality of Aviation Education</u>

(Listed in order of number of times cited)

High Quality Faculty

Good Overall Program

High Quality Facilities

High Quality Students

Strong Flight Simulator Department

Academic Support

Concentration of Aviation Studies

Networking with Aviation Industry

Student Job Placement

Blend of Liberal Arts Curriculum

Student Oriented Faculty

Professional Program

General Business Background

Internships in Industry

Good Communication Skills

New Curriculum

Adequate Funding of Program

Program Safety

Other Factors*

*Eight other responses recorded in survey mentioned only once, and are not listed in above factors.

The next survey question asked the respondent to comment on factors that make a high quality aviation education. The question was, "What do you feel is necessary in order to provide excellence in Aviation Education?" This is similar to the preceding question, however the word excellence was emphasized by the interviewer. Some of the same responses occur in the next list, however it is interesting to note that many different responses were obtained when excellence was in fact substituted for good.

<u>Necessary Factors to provide Excellence in Aviation Education</u>

(Listed in order of number of times cited)

High Quality Faculty

High Quality Facilities

Networking with Aviation Industry

High Quality Aviation Program

Academic Support

Adequate Funding of Program

Professional Program

Conduct Research in Aviation

Program contain Interested Students

Variety of Aviation Courses Offered

Student Oriented Faculty

Industry Involvement in Curriculum

Provide Job Placement Services

Greater Emphasis on Aviation Safety

Promote Critical Thinking Skills in Students

Provide Internships in Aviation Industry

Provide More Financial Aid To Students

Other Factors*

*Seven other responses recorded in survey mentioned only once, and are not listed in above factors.

Program directors were then asked, "If you had unlimited resources, what three changes would you make in the Aviation Education program at your institution?" The most answered response was to improve facilities. The following list describes the responses given:

Proposed Improvements in Aviation Education

(Listed in order of number of times cited)

Improvement of Facilities

Improvement and Addition of Flight Simulators

Increase Faculty Number

Increase number of Available Aircraft

Improve Teaching Aids

Increase number of Aviation Programs

Increase Student Recruitment

Increase Marketing Budget

Increase number of Hands-On Activities

Provide More Student Internships

Increase Faculty Travel

Improve Student Placement System

Increase Industry Involvement

Add Masters Degree Program In Aviation

Increase Library Resources

Initiate Research Center

Increase Number of Field Trips

Offer Additional Scholarships

Increase Faculty Development Programs

Other Factors*

*Five other responses recorded in survey mentioned only once, and are not listed in above factors.

The top 12 responses of each of the three preceding lists were then organized into a written questionnaire (see appendix B.) which was mailed to the UAA member institutions with four-year degree programs. These three questions were considered to be of greatest importance to establishing the norm of quality aviation education throughout the United States. The top 12 responses were chosen to make the ranking by the program directors less difficult. All responses that were recorded more than twice on the original survey were included. The ranking of each of the top 12 groups of responses in a written format allowed for both a reaffirmation of previous oral responses and the opportunity to rank the other respondents opinions.

Forty two program directors returned the survey. This is a response rate of 61.8%. When asked to rank the factors of a high quality aviation education the following responses were obtained. (See Table I) The following method was employed to determine rank. A point system was used in the following manner. When a factor was ranked first, twelve points were awarded to this factor. If that factor ranked second, eleven points were awarded. This system was applied down to the lowest rated factor, which received only one point. By using this method rank can be established, by noting the factor that obtains the highest number of points. The factors are also listed in order from highest to lowest. The following table summarizes the responses. (Table I)

TABLE I

FACTORS OF HIGH QUALITY AVIATION EDUCATION PROGRAMS

Statement	Points
High Quality Faculty	437
Good Overall Program	350
Student Oriented Faculty	334
High Quality Students	319
Academic Support	316
Professional Program	272
High Quality Facilities	260
Networking With Aviation Industry	258
Concentration Of Aviation Studies	204
Student Job Placement	196
Blend Of Liberal Arts Curriculum	191
Strong Flight Simulator Department	143

The survey responses indicated that a high quality faculty is the number one response by a large factor. This was the most cited factor and was ranked by the mail survey also as the number one factor. A good overall program was the second highest cited response, and it was also second highest in the mail survey. However, the third ranked response was student oriented faculty which ranked eleventh in the phone survey. Fourth place in the mail survey was high quality students, with academic support following. The top ranked six responses are as follows:

Factors of High Quality Aviation Education Programs

(Top Six Responses)

High Quality Faculty

Good Overall Program

Student Oriented Faculty

High Quality Students

Academic Support

Professional Program

Survey respondents were then asked to rank the necessary factors to provide excellence in aviation education. The following table provides the results by the use of the point system as previously described. (Table II)

TABLE II

NECESSARY FACTORS TO PROVIDE EXCELLENCE IN AVIATION EDUCATION

Statement	Points
High Quality Faculty	430
Student Oriented Faculty	372
High Quality Aviation Program	333
Adequate Funding Of Program	322
Academic Support	311
Professional Program	287
Program Contains Interested Students	250
High Quality Facilities	220
Industry Involvement in Curriculum	213
Networking with Aviation Industry	206
Variety of Aviation Courses Offered	204
Conduct Research In Aviation	101

High quality faculty was the number one ranked response in both the telephone survey by citation and in the mail survey by ranking. The second highest cited response high quality facilities did not make it to the top six responses falling to eighth place in the mail survey ranking. The mail survey ranked a student oriented faculty as the second highest response which barely made the top twelve factors of the original list. The top six necessary factors to provide excellence in aviation education are as follows:

<u>Necessary Factors To Provide</u>
<u>Excellence In Aviation Education</u>

(Top Six Responses)

High Quality faculty

Student Oriented Faculty

High Quality Aviation Program

Adequate Funding of Program

Academic Support

Professional Program

Finally program directors were asked to rank twelve proposed improvements in aviation education. The following table represents by the aforementioned point system the rank established by the mailed survey: (Table III)

TABLE III

RECOMMENDED IMPROVEMENTS IN AVIATION EDUCATION

Statement	Points
Provide More Student Internships	348
Increase Faculty Number	345
Increase Number Of Hands On Activities	332
Improve Teaching Aids	318
Improve Student Placement System	302
Improvement Of Facilities	300
Increase Student Recruitment	274
Improvement And Addition Of Flight Simulators	240
Increase Marketing Budget	233
Increase Number Of Available Aircraft	207
Increase Faculty Travel	168
Increase Number Of Aviation Programs	159

Surprising to the author the number one ranked response was to provide more student internships. Not that this is not a good response, but it almost did not make the top twelve cited list, coming in at tenth place. Also improvement of facilities the number one cited response fell to sixth place in the mailed survey. The following list represents the top six ranked proposed improvements in aviation education:

RECOMMENDED IMPROVEMENTS IN AVIATION EDUCATION

(Top ranked six factors)

Provide More Student Internships

Increase Faculty Number

Increase Number of Hands on Activities

Improve Teaching Aids

Improve Student Placement System

Improvement of Facilities

This study provided a peer-referenced national-based group of proposed improvements in collegiate aviation education. It is the hope of the author that this work will provide a basis for such improvements. Obviously some improvements are more practical to initiate than others, however with the peer-referenced priorities as established in this study the program director may be guided in decisions involving improvements in educational quality.

BIBLIOGRAPHY

Kuhns, R. M., (1994). Kansas Aviation Education: A Comparison against National Norms. Oklahoma State University, Stillwater, OK.

Perry, K. (1988). Designing Questionnaires. ABSED5720.08, Oklahoma State University, Stillwater, OK.

Schukert, M. A., (1992) Post-Secondary Aviation & Space Education Reference Guide. Washington, D. C.: F.A.A.

University Aviation Association, (1992) April 1992 Membership List. Auburn, AL: University Aviation Association.

Williamson, C., (1994) Collegiate Aviation Guide, Reference Guide of Collegiate Aviation Programs. Auburn, AL: University Aviation Association.

AVIATION EDUCATION TELEPHONE SURVEY
APPENDIX A

Institution name____

Street Address____

____

Contact person____

Title__________________________Phone______________________

Date____________________Time___________________

1. What is the size of your parent institution?__________

2. How many Aviation education students are currently

enrolled? AS_____, BS_____, MBA_____, MS_____,
Ed.D._____, Ph.D._____,
Other_____ (if so, please specify)

3. What is the highest aviation degree offered?

Circle one: AS BS MBA MS Ed.D Ph.D

4. Within the next two years, does your institution plan to offer any higher level Aviation education degrees than presently offered? Yes____ No____. If yes what? (circle) BS, MBA, MS, Ed. D., Ph. D., Other _______________

5. What year was your aviation program established?_______

6. Faculty demographics:
Number of full time aviation faculty___________
Number of part time aviation faculty___________
Number of minority aviation faculty____________
Number of women aviation faculty_______________
Number of aviation faculty with degree higher than baccalaureate_____________________________
Number of aviation faculty with degree higher than masters___________________________________

7. Using a scale of 1 to 5 with 5 being highest quality how would you rate your aviation program as compared to other similar programs? 1 2 3 4 5

8. How do you feel your aviation program would rate against a nationwide norm?

_____One of the best
_____Better than most
_____Average
_____Somewhat below the norm
_____One of the worst

9. Does your institution offer any aviation education scholarships? Yes No If so, what types?

____

____

10. Would you characterize your aviation education program as growing, remaining constant, or declining in student number? (circle one) What factors do you attribute this to?

____

____

11. What factors constitute a good Aviation Education program?

____

____

____

____

12. What do you feel is necessary in order to provide excellence in Aviation Education?

____

____

____

____

13. If you had unlimited resources, what three changes would you make in the Aviation Education program at your institution?

____

____

____

____

____

14. What options are available in your Aviation Education program? (Check those that apply)

Aviation Management Program_________________

Flight Training________________

Aircraft and Powerplant Training_____________________

Airway Science:

Airway Science Management______________
Airway Computer Science________________
Aircraft Systems Management____________
Airway Electronic Systems______________
Aviation Maintenance Management________

Other____

15. What institution in your opinion offers the best aviation education in the United States.

In four year programs?_______________________________________

At masters level or higher?_________________________________

16. How would you rate your institution in relation to one or more of the preceding best institutions on a scale of 1-5 with 5 being the aforementioned institution? 1 2 3 4 5

17. How many of the following are available in your program?

Flight training aircraft_______________
Flight training simulators_____________
Certified Flight instructors___________
Certified Ground instructors___________
Aviation Scholarships__________________

18. Would you describe your program as being accessible to

students from other states? Yes_____ or No_____. If yes, to what degree do you rate your institution's accessibility?

Very accessible_________________________
Somewhat accessible_____________________
Limited accessibility___________________

19. Do you actively recruit students? Yes _____ No _____.

If so, how? ____

____

20. Do you follow-up on graduates? Yes _____ No _____.

If so, how frequently? _____________________________________

____

21. Is your institution currently a member of The Council on Aviation Accreditation? Yes_____ No _____ Do you plan to join in the future? Yes _____ No _____

APPENDIX B

FOLLOW-UP WRITTEN QUESTIONNAIRE

Robert M. Kuhns
125 S. Hillside
Wichita, KS 67211
316 682-1921

February 26, 1993

Dear Colleague:

Early this summer I contacted you by phone to participate in my doctoral dissertation study about aviation education. Those of you that participated in the previous study provided me with some interesting results. Three key questions of the survey have been paraphrased below with their most frequent responses. Please rank (1-12) the responses in order of importance (1 being the most important) and return your response to me in the self addressed stamped envelope.

<u>Statement: Factors of High Quality Aviation Education Program</u>

Rank (in order of importance)

_______ Concentration of Aviation Studies
_______ Blend of Liberal Arts Curriculum
_______ High Quality Faculty
_______ Professional Program
_______ High Quality Facilities
_______ High Quality Students
_______ Strong Flight Simulator Department
_______ Academic Support
_______ Good Overall Program
_______ Networking with Aviation Industry
_______ Student Job Placement
_______ Student Oriented Faculty

Statement: Necessary Factors to provide Excellence in Aviation Education

Rank (in order of importance)

_______ Variety of Aviation Courses Offered
_______ Professional Program
_______ High Quality Facilities
_______ Networking with Aviation Industry
_______ High Quality Aviation Program
_______ Academic Support
_______ Adequate Funding of Program
_______ Industry Involvement in Curriculum
_______ Conduct Research in Aviation
_______ Program contain Interested Students
_______ High Quality Faculty
_______ Student Oriented Faculty

Statement: Proposed Improvements in Aviation Education

Rank (in order of importance)

_______ Increase number of Hands On Activities
_______ Improve Teaching Aids
_______ Improvement and Addition of Flight Simulators
_______ Increase Faculty Number
_______ Increase number of Available Aircraft
_______ Improve Student Placement System
_______ Increase number of Aviation Programs
_______ Increase Student Recruitment
_______ Increase Marketing Budget
_______ Improvement of Facilities
_______ Provide More Student Internships
_______ Increase Faculty Travel

In order that I may complete my doctoral dissertation research in a timely manner please respond as quickly as possible. A control number has been assigned so that I may track responses. Your response will be kept confidential.

Thank you,

Robert M. Kuhns

FLIGHT INSTRUCTOR GRADING BIAS INVOLVING STUDENTS WITH RACIAL, ETHNIC AND GENDER DIFFERENCES

by

Wade R. Helm
Adjunct Assistant Professor
Embry-Riddle Aeronautical University
College of Career Education, NAS Pensacola Resident Center, Florida

Flight Instructor Bias Involving Students with Racial, Ethnic and Gender Differences

Abstract

Of 1038 naval flight students, 943 Caucasian males, 23 African American males, 41 Hispanic males and 31 females had their flight training performance analyzed. Aviation selection test scores, academic grades and flight grades were examined to determine objective and subjective grading reliability. To facilitate cross comparison all test scores were transformed into Navy Standard Scores with a mean of 50 and standard deviation of 10. It was hypothesized that flight instructor grading bias would appear as inconsistent means and/or variances compared to objectively derived aptitude and academic performance. Comparing flight instructor subjectively determined flight grades to objectively determined aptitude scores and academic grades revealed no significant difference for Caucasians, African American or Hispanic males. However, there was significant difference between female aptitude scores and flight grades. Female flight grades were significantly higher than aptitude scores would predict. No other differences were found. Conclusions about flight instructor grading bias is fairly clear. For males there appears to be no bias. For females the bias is positive, ie., higher flight grades than would be predicted by their flight aptitude scores. In general, flight instructors grading patterns were extremely consistent when compared to objectively determined aptitude and academic test scores.

FLIGHT INSTRUCTOR GRADING BIAS INVOLVING STUDENTS WITH RACIAL, ETHNIC AND GENDER DIFFERENCES

Wade R. Helm

Embry-Riddle Aeronautical University
NAS Pensacola, Florida

"Black aviators often face subtle and 'intangible' forms of discrimination such as tougher grading in flight school and promotion evaluations." These comments were made by a African American Naval Commander assigned to the Navy's personnel department. He goes on to state that only 2.1 percent of Naval aviators are black (opposed to 12 percent for the general population). Black aviators are assigned to fighter and attack planes at barely half the rate of white aviators and there are only two commands out of 93 aviation commands that are held by blacks. Furthermore, these discrepancies are responsible for low morale and higher attrition rates (twice the rate of whites) among black aviators (Pensacola News Journal, 1992).

Other minorities as well as females have made similar accusations of subtle bias especially about flight instructors who consciously or unconsciously grade them lower than male Caucasians. Based on these allegations, the Navy instructed a review of Navy flight instructor grading procedures with emphasis on determining the possibility of grading bias.

Method

Subjects - Of 1038 naval flight students 943 Caucasian males, 23 African American males, 41 Hispanic males and 31 female naval flight students had their performance analyzed.

Performance was determined to be objectively or subjectively derived. Aviation selection test scores and academic ground school grades are both machine scored and, therefore, objectively derived. Flight grades on the other hand are subjectively derived based on flight instructor ratings of specific flight performance. In order to compare performance across the various type of scoring and/or grading procedures, all raw scores were converted to Navy Standard Scores (NSS) with a mean of 50 and a standard deviation of 10. To compute an NSS from a group of raw scores calculate a mean and a standard deviation. Take each raw score and subtract the group mean and multiply the result by 10 then add 50. In a normal distribution the NSS will range from a low of 20 to a high of 80 with a mean of 50. Each 10 points is equivalent to one standard deviation. This procedure allows a direct performance comparison between test scores with dissimilar units of measurement (Sax, 1980).

All flight students had Aviation Selection Test Battery (ASTB) scores, ground school grades and flight grades. The ASTB has the following components that predict academic and flight training success:
a. Academic Qualification Rating (AQR) -

Predicts academic aptitude.
b. Pilot Flight Aptitude Rating - Predicts Pilot flight aptitude.
c. Flight Officer Aptitude Rating (FOFAR) - Predicts NFO flight aptitude.
d. Pilot Biographical Inventory (PBI) - Predicts Pilot interest.
f. Flight Officer Biographical Inventory (FOBI) - Predicts NFO interest.

All ASTB scores are reported in stanines. Stanines range from a low of 1 to a high of nine with 5 as average. All ASTB scores were converted to the NSS with a mean of 50 and a standard deviation of 10 (Sax, 1980).

Academic performance was derived by grades on three ground school courses (1) Aerodynamics, (2) Engines, and (3) Navigation. All three course scores were combined into an equally weighted composite then converted to an NSS score with a mean of 50 and a standard deviation of 10.

Finally, flight grades are scored on a 1-4 point scale. One is the low and four is the high, the average is 3.0. All flight scores were converted to an NSS with a mean of 50 and a standard deviation of 10.

Results

Mean score for each group for the dependent variables are shown in Table 1 on following page.

Naval Standard Scores for each group for the dependent variables are shown in Table 2 on following page..

A z or t-score analysis was performed for each category of dependent variable. A significant z of 2.57 ($p < .02$) was found between female PFAR scores and flight scores. All other z's or t's were non-significant.

Discussion

The claim that minority and/or female flight students face tougher grading standards than their majority or male counterparts is not supported by the study. The only difference in flight instructor grading occurred with female flight students. Female flight students received significantly higher flight grades (46.4) than was predicted by their flight aptitude scores (41.3).

There were no significant differences for Caucasians, African American or Hispanic males. Conclusions about flight instructor grading bias is fairly clear. For males there appears to be no bias in grading. For females the bias is positive, ie., higher flight grades than would be predicted by their flight aptitude scores. In general, flight instructors' grading patterns were extremely consistent when compared to objectively determined aptitude and academic test scores.

Table 1

Mean scores by Race, Ethnic or Gender code

Code	Number	AQR	PFAR	FOFAR	PBI	FOBI	ACAD	FLT
CAUC	943	5.96	6.20	5.74	6.15	5.33	50.88	51.37
AF AM	23	3.69	4.21	3.49	4.08	3.64	44.39	45.11
HISP	41	5.14	5.40	4.90	5.24	4.48	49.02	47.81
FEMALE	31	4.67	4.67	4.70	5.23	4.99	47.36	47.60
TOTAL	1038	5.86	6.04	5.59	5.99	5.23	50.42	50.88

*ASTB scores are in stanines (Range 1-9)

Table 2

Naval Standard Scores by Race, Ethnic, or Gender Code

Code	Number	AQR	PFAR	FOFAR	PBI	FOBI	ACAD	FLT
CAUC	943	50.9	51.0	50.8	50.8	50.5	50.7	50.5
AF AM	23	37.9	39.5	38.1	40.2	42.1	41.3	43.6
HISP	41	46.2	46.2	46.1	46.1	46.3	48.0	46.6
FEMALE	31	43.5	41.8	45.0	46.1	48.8	45.6	46.4
TOTAL	1038	50.0	50.0	50.0	50.0	50.0	50.0	50.0

* Significant .05

References

Anonymous. Pentagon: Navy Aviation discriminates. Pensacola News Journal, October 14, 1992.

Sax, G. Principles of Educational and Psychological Measurement and Evaluation. California: Wadsworth Publishing Company, 1980.

INSTRUCTIONAL CONCEPTS AND TECHNIQUES FOR THE FLIGHT AND AVIATION MAINTENANCE INSTRUCTOR

by

Thomas F. Walby
Adjunct Instructor
Embry-Riddle Aeronautical University
College of Career Education, Miami Resident Center, Florida

Table of Contents

(Kirby, Moore & Schofield, 1988), there has been a growing concern for the general predispositions that learners bring to any learning task. This research, now termed 'approaches to learning', examines the ways in which learners use motives and strategies when they learn (Watkins & Hattie, 1990). Since the focus of this paper is on Pilot and Mechanic training, the effects of 'approaches to learning' on pilot and mechanic learning, training and instruction will be highlighted.

The literature shows that there are various approaches to learning which have been identified through factor analytic methods. Extensive research by Biggs (1979; 1985; 1987) with high school and university students identified three similar basic approaches to learning. Biggs (1987) calls these 'Surface, Deep, and Achieving Approaches', each constituting a set of motives and strategies.

Learners with a 'surface approach' are motivated to meet minimal course requirements and achieve their goals by rote learning and strategies designed just to reproduce what they have learned. On the other hand, learners using a 'deep approach' are more intrinsically motivated, seek to personalise their learning and undertake meaning-oriented activities. Finally, learners with an 'achieving approach' are motivated to seek high grades, to enhance their egos through competition, and to organize themselves for learning.

For pilots and mechanics, the question which follows is whether or not particular approaches are more appropriate for them, given the nature of their education and training. Are there subjects or exercises in which a surface approach may be more effective than a deep approach and *vice versa*? If, for instance, a topic is relatively easy to learn, essentially detail oriented and not structurally complex (such as learning a priliminary cockpit check sequence or a standard operating procedure), there might be a good case for employing a surface approach. If a topic is structurally complex and requires substantial integration for meaning [such as aerodynamics or computer theory], then a deep approach may prove more beneficial.

Most research on approaches to learning has been conducted on school and university populations. However, aviation differs from these contexts in seven ways (Telfer, 1993, p213):

a) <u>Effectiveness vs. Efficiency</u> [Instruction in aviation has to occupy the minimum time necessary to achieve the specified level of competency],

b) <u>Education vs. Training</u> [there is an essential difference between education for living in society, and training to fill an occupational or professional role in that society],

c) <u>The Learning and Instructional Environment</u> [vital periods of flight instruction occur, at times, in a cramped, noisy and mobile setting with unpredictable distractions],

d) <u>Teachers vs. Flight or Maintenance Instructors</u> [there appear to be clear limits on the amount of time a flight or maintenance instructor will devote to professional development as an educator],

e) Theory vs. Practice [until recently, instructional effectiveness has been the focus of researchers, not flight or maintenanc instructors],
f) Art vs. Craft [the culture of flying is distinctive. The nature of the 'right stuff', the kinship of pilots and mechanics, the values, language, attitudes and norms all contribute to an unusual instructional setting. There is undoubtedly an *art* as well as a *craft* of aviation instruction (Telfer and Bent, 1992). Some individuals have the advantage of special experience, abilities, insight and nature which gives them a considerable personal advantage as an instructor.

Ongoing studies of effective aviation instruction will enable the body of theory to expand so that it encompasses planning, preparation, presentation, assessment amd management. Concurrently, the instructor preparation programs will become more efficient (Telfer, 1993)].
g) Pedagogy vs. Androgogy [the average age of pilots and mechanics puts them in a category of adult education for which androgogy rather than pedagogy provides the guiding principles of learning. Androgogy is based upon the notions that adult learning is characterized by different self-concepts; a reservoir of experience as a learning resource; a readiness to learn; and an internal or intrinsic source of motivation (Jarvis, 1987). This means that there is a difference in the way the instructor interacts with adult learners, and the ways in which adult learners perceive the relationship (Telfer, 1993, p214)].

"Given these differences, it follows that the motivation to learn in aviation may be quite different from that in schools and universities as there are clear personal goals to be achieved. Career prospects depend directly upon performance in training, and there are usually both time and financial constraints. In addition, the aviation industry tends to encourage the use of mnemonics to remember information, and the development of an instructor 'patter': both approaches that arguably reflect a to learning.

The instructional focus at all levels of training should be on the adoption of deeper learning approaches which can be encouraged. In classroom, simulator and aircraft instruction, there should be an encouragement of self-questioning, monitoring and evaluating in a relatively anxiety free environment. For the instructor this implies constant monitoring of the trainee, especially in the cockpit environment, where cognitive overload is easily induced." (Telfer, 1993, p216) In understanding the "" the flight or maintencance instructor will be better prepared, not only in lesson planning and presentation, but also in evaluation.

Summary:

For the reasons enumerated above, the author sought to find a basic reference work(s) in instructional concepts and techniques for the flight and maintenance instructor. Although many various articles, SOPs and manuals have been published by governmental agencies, airlines, aircraft manufacturers and flight schools (ie., Irvin Gleim's Flight/Ground Instructor: FAA

Written Exam and Fundamentals of Instructing: FAA Written Exam, FAA's Flight and Ground Instructor Written Test Book: FAA-T-8080-18A, and Jeppesen's Flight Instructor Manual), none seemed to give to the instructor a concise view of those principles necessary for effectively teaching flight related subjects to their students.

Of special interest is the manual entitled, Aviation Instructor's Handbook, published by the US Department of Transportation in 1977, which comes very close to meeting the need outlined above. It was felt that although much, if not all, of the material presented in this handbook was of use to the flight or maintenance instructor, the presentation was cumbersome and some basic concepts were left untouched.

It is believed that the manual which is offered in the following chapters broaches the subject in a clear and concise manner and can be digested by a flight or maintenance instructor in a short period of time, while specifically targeting those instructional concepts and techniques necessary for flight or maintenance instructors to do their job. As an additional positive aspect, it's design of presentation lends itself to being used as a checklist during the various phases of instruction and evaluation.

Although this manual is by no means complete, it is a step toward a simplified standard body of material in the area of instructional concepts and techniques. It can be read and understood by the flight or maintenance instructor who has had no formal training in, "Education," and who does not, for whatever reason, wish to complete further formal undergraduate or graduate training as a teacher.

Conclusions:

If there is an emerging "profession" of flight instruction, as alluded to by Telfer (1993, p1), then it is incumbent on all who call themselves flight and maintenance instructors to assure that they are, in fact, professional in their approach. If there is a, "recognizable theoretical base for aviation instruction," (Telfer, 1993, p2) then we, in the profession, should get on with the job of standardizing that base. And if there are recognizable courses in instructor preparation both in place and in development (Telfer, 1993, p2) then we must do our best to attend these courses and provide them to all flight and maintenance instructors whom we supervise. The manual offered in the following chapters is a step toward simplification and standardization of this subject matter.

On March 8, 1995, the manual which is offered here, was accepted by the Airbus Industrie Training Organization Instructor Training Techniques Working Group as the reference manual to be used in the initial and recurrent Instructional Concepts and Techniques training of all Airbus Flight and Maintenance Instructors in order to meet future FAA, MOT, CAA, DGAC or JAR Advanced Qualification Program (AQP) instructor training requirements. It is currently being used at the Airbus Training Center in Miami to meet training requirements under FAR Advisory Circular 120-54.

Chapter 1: Factors Affecting Student Perception

Overview:

For learning to proceed efficiently, the instructor requires an understanding of the factors which affect the student's perceptions:

➔ Physical State
The physical well being of an individual affects that person's capability to receive information.

➔ Psychological Needs
The self-concept of an individual may affect that person's desire to receive information. If the student has a negative experience which contradicts his self-image, he may **block out** the experience. If the student has a poor self-concept, perceptions may be inhibited by psychological barriers called **defense mechanisms**.

➔ Goals and Values
The commitment and motivation of an individual will affect the quality of perceptions. Highly valued things are pursued more intensely.

➔ Time and Opportunity
The opportunity to receive information, and the time to relate that information to previous learning, affects the quality of perceptions.

➔ *Element of Threat*
Fear adversely affects a student by narrowing the perceptual field. Attention is focused on the threatening object or condition. Any action by the instructor that is **interpreted** as threatening, makes the student less able to accept the experience. If the training situation becomes overwhelming to the student, a threat exists. Threatening a student with unsatisfactory reports is not an effective way to enhance his desire or capability to perceive. Learning is not necessarily a logical problem: learning is a problem.

Perceptions, or meaningful blocks of **input**, are organized, related, and associated by the brain. The result is called **knowledge**. Learning is the acquisition of knowledge and is demonstrated by behavioral change which utilizes that knowledge.

Insight:

As perceptions increase in number, the student assembles them into larger **blocks**. Without new experience, there can be no new perceptions, but, as previous input is organized, related, and associated, an active cognitive process called **insight** may occur.

The mind actively processes the information received into new forms. Insight may result in inspirational solutions to problems. Insight contains the ability to apply solutions previously learned to new problems, or to **generalize**. Forgetting is less of a problem because there are more anchor points. For instruction to be efficient, the information must be presented in a meaningful way which assists the student's organization and association. It is very difficult to recall disorganized or unrelated information. Pointing out relationships, providing a secure environment in which to learn, and helping the student maintain a favorable self-concept are most important in fostering insights. The student's task of remembering the material is made much easier by organized presentation and directed practice.

Memory:

Learning is related to memory. memory may be divided into three separate systems:

1. *Sensory memory* is made up of the lingering traces of information sent to the brain by the senses. The information is immediately forgotten unless transferred to short-term memory. (e.g., a radio frequency to be used only once.)

2. *Short-term memory* receives information from sensory memory, rehearses it, and transfers it to the next stage. The efficiency of the transfer process depends, to a great extent, on the organization of the material. Information not transferred is shortly forgotten. (e.g., a radio frequency which will be used often.)

3. *Long-term memory* permanently stores information. If the material is properly organized, it can be recalled or retrieved. (e.g., the same frequency **memorized**.)

Forgetting:

Major theories of forgetting are speculative to some degree, and all may be partly true at certain times:

➔ *Disuse or failure in the retrieval process*

Memory may be below the level of conscious capability.

➔ *Interference*

A certain experience may overshadow, or intervene with, the material. Very similar material appears to interfere with memory more than dissimilar material.

➔ *Repression or motivated forgetting*

Some submersion of unpleasant ideas into the unconscious mind occurs because the anxiety producing material is protectively and selectively **forgotten**. The material is so upsetting that remembrance is avoided: we forget because we want to forget.

➔ *Fading or distortion of the memory trace*

The strength of the biochemical memory pattern tends to fade away with time.

Frequently, when new learning occurs, we quickly forget much of what we have learned, but we remember some portion for a very long time. The various theories of learning imply that the material is not lost, but merely unavailable for recall.

Chapter 2: Retention of Learning

The instructor's task is to make certain that the students learn the material so well that the information or skill is available for recall. Drill, recitation, and quizzing assist the student in establishing information in memory. Recitation has been shown to be an extremely effective method during initial learning. Habit patterns, which have been firmly established by repeated usage, are retained and may be recalled even after years of disuse. Memory, which stores that learning classified as knowledge, has a major role in the retention of motor skills, and is a major factor in learning.

There are five principles which affect the retention of learning:

➜ *Praise stimulates remembering*

Responses which give pleasurable return tend to be repeated. Absence of praise or recognition tends to discourage remembering, and any form of negativism tends to make recall less likely.

➜ *Recall is promoted by association*

Unique or disassociated facts tend to be forgotten unless they are of special interest or application.

➜ *Favorable attitudes aid retention*

People learn and remember only that which they wish to know. Without positive motivation, based on rewarding objectives, there is little chance for recall.

➜ *Learning with all our senses is most effective*

When more than one sense responds to an event, a stronger impression of the experience results.

➜ *Meaningful repetition aids recall*

Each repetition gives the student the opportunity to gain a clearer and more accurate perception. Practice provides the opportunity for learning, but does not cause it.

Chapter 3: Motivation

Overview:

Positive motivation is essential to learning and is the dominant force which governs a student's progress. The instructor can use the student's desire for personal gain, comfort, security, group approval, or personal achievement to advantage. Negative motivation (e.g., threats or reproof) should be avoided. Motivation may not remain at a uniformly high level. Slumps in learning are often the result of slumps in motivation which may be related to external influences.

Students want a tangible return for their efforts. Praising students who have performed well encourages greater effort. Prestige, or group approval, is an extremely powerful motivational force. Confidence, through confirmation of a positive self-image, results in rapid progress. New material, based on previous achievements, can facilitate confidence in a building block approach to a syllabus. Conversely, failure breeds disappointment in a cycle difficult to interrupt. The goal must be clear and the reward constantly apparent. If the importance of a lesson is not apparent to the student, an explanation of the relationship of the lesson to the overall goal is required. Avoid significant drill and practice on operations which do not contribute to performance.

Hierarchy of Human Needs:

When a need is satisfied, it no longer provides motivation, and the individual strives to meet the next level of needs.

➔ *Physical Needs*

Until the needs for food, rest, exercise, and shelter are met, people cannot concentrate on learning or self- expression.

➔ *Safety Needs*

Protection against danger, threat, and deprivation.

➔ *Social Needs*

Social needs include belonging, associating, giving, and receiving friendship and love. Students separated from normal surroundings have a pronounced need for association and belonging.

➔ *Egoistic Needs*

Egoistic needs have a direct influence on the student - instructor relationship. There are two distinct groups:

➠ Needs related to **self-esteem:** need for self-confidence, independence, achievement, competence, or knowledge.

➠ Needs related to **reputation**: need for status, recognition, appreciation, or respect.

➔ *Self-fulfillment (self actualization) Needs*

Self-fulfillment needs include

realizing potentialities, continued development, and creativity. Aiding a student in realizing is the most worthwhile accomplishment of an instructor. When an instructor works toward understanding human relations, students experience fewer frustrations and devote more attention to learning.

Motivation and Learning:

The factor that perhaps has the greatest influence on learning is motivation, the force that causes a person to move toward a goal. It can be rooted in any of the hierarchy of human needs which compel people to act, to move, to start working toward an objective, or achieve a purpose. The task of instructors is to first recognize and identify these needs.

Students must be motivated in order to maximize and sustain their efforts. A student's desire to fly or fix an aircraft is not sufficient to sustain activity because it is a long-term goal. It is difficult to see how each day's efforts contributes to the distant certification. Motivation must be put on a daily basis; that is, each session must have its own reward.

These daily incentives are classified into two types; those that are related to the subject being learned, and those not related to it:

➜ *Intrinsic*

This is the motivation of a student by means directly related to the subject. If instructors show the students how each session, maneuver, and briefing will help them become better pilots, or to learn the next maneuver, pass the oral, written or evaluation ride, they are using intrinsic motivation. This type of motivation produces the best results.

➜ *Extrinsic*

This is the motivation of a student by means indirectly related to the subject. If the instructor uses things outside the subject, such as social approval, esprit de corps, etc., extrinsic motivation is being used. There is a distinct place in the overall process for this type of motivation.

Whether motivation is positive or negative depends, in most cases, on the instructor's approach. Positive motivation promises a reward, while negative motivation makes a threat. Positive motivation should be used in preference to negative motivation although negative motivation can be used as a **LAST RESORT**. It will often cause a great deal of activity, if only for a short time.

As a general rule, there are three types of negative motivation which should never be used. They are:

☹ *Sarcasm*

Derogatory language (used even in a joking manner), or saying the opposite of what is meant will cause not only resentment and uncertainty, but also will quickly destroy the proper student-instructor relationship.

☹ *Ridicule*

Scornful language, designed to belittle or humiliate, will ultimately destroy the student's respect for the instructor.

☹ *Fear*

Mild fear can be used effectively, as in physical security (see, *Law of Intensity*). Strong fear should never be used because student reaction is unpredictable; it may assume such proportion as to cause failure in training.

Chapter 4: The Learning Process

Levels of Learning:

Learning can be considered as occurring on different levels:

➔ *Rote learning* is simply a performance, a read-back, with no understanding.

➔ *Understanding* occurs as insights form.

➔ *Application* involves the ability to apply the knowledge in a useful way.

➔ *Correlation* involves the ability to associate the blocks into meaningful wholes and understand the relationship of the parts. The ability to generalize, or apply the technique to the solution of new problems, is achieved.

The Performance of Skills:

The process of learning to perform motor or mental skills appear to be the same. Learning a physical skill requires practice: similarly, mental skills require practice. If students are to use sound judgement, they must have learning experiences where judgement is exercised. If students are to solve problems successfully, they must have experience in applying principles to solve realistic problems. (LOFT)

A clearly organized example which demonstrates the pattern to follow is necessary for efficient learning. While a muscular sequence is learned, conceptual and attitudinal changes will occur.

The instructor must be cautious that incidental learning does not detract from the overall goal. Impressing a student with the difficulties or dangers of a task may be well meaning, but may serve to discourage the student or otherwise make learning difficult.

Practice of the skill is necessary to achieve a satisfactory level of performance, but a beginning student reaches a point where additional practice is unproductive and may be harmful. Errors may increase and motivation declines. Three or four repetitions provide the maximum effect, and the rate of learning, or probability of retention, falls rapidly with more trials in one session. As experience increases, longer practice periods may be profitable.

Mistakes are not always apparent to the student. It is important for students to know when they are correct. Mistakes should not be practiced. It is far more difficult to unlearn than to learn. If necessary, repeat demonstrations or examples to show the standard.

Progress follows a consistent pattern. Rapid improvement during early trials is followed by a **Learning Plateau**. If the student is aware of the normal leveling process, unwarranted frustration may be avoided. It is possible that the student's limit of capability has been reached, but the apparent lack of increasing proficiency does not necessarily mean that learning has ceased. If the student's interest has waned, the instructor may need a more efficient method for increasing progress.

During the initial stages of learning a task, practical suggestions are more helpful than a grade. Specific comments are more meaningful and useful after the skill has been partially mastered.

Students must learn the performance of tasks to a point where the skills required are habitual. Overlearning skills may make performance of the task easy.

Habit Formation:

Habit formation is essential for correct performance after initial training. Each simple task must be performed correctly before the next task is introduced. The introduction of instruction in advanced or complex operations, before the elements are mastered, leads to the formation of incorrect habit patterns. The faulty performance of the elements of a complex task carries through to future learning.

Transfer of Learning:

There is some degree of transfer in all learning. New learning is based upon previous learning, and people interpret new things in terms of what they know. When a student is aided by things previously learned, the transfer is positive. Negative transfer occurs when a student is hindered by things previously learned.

Students of equal ability may have different success because of positive or negative transfer. It is important for the instructor to have knowledge of the student's previous experience.

The sequence of course material should be planned so that each phase provides positive transfer to the next phase. Positive transfer should be planned as a major objective.

Students must recognize the types of situations where it is appropriate to use specific skills. The instructor must make certain that students understand when to apply that which has been learned to other situations. Use instructional material that helps the student form generalizations and makes the relationships clear.

Obstacles to Learning:

The following obstacles to learning are common to flight instruction and have been recognized as major factors:

➔ *A student's feeling of unfair treatment*

If a student believes that his instructor is not **supportive**, that the student's presence is not welcome, that the instructor does not care about his progress, or that impossible demands are being made, the student's motivation will suffer. The assignment of difficult, but unattainable goals will be seen as challenging.

➔ *The student's impatience to proceed to more interesting operations*

The impatient student does not understand the need to master basics. The instructor should clearly identify the elements mastered in preceding steps as they apply to a demonstration of subsequent steps.

➔ *Student worry, or lack of interest*

The instructor cannot be responsible for outside influences that affect the student, but he/she must consider their influence on the student. Instruction must be keyed to the utilization of the student's interests and enthusiasm and to diverting attention away from worries and troubles.

➔ *Physical discomfort*

Symptoms of illness or fatigue will frequently affect vision, hearing, feeling, balance, or alertness, which are essential to a correct performance by a flight crew member. Effective instruction cannot be conducted when the student is incapacitated.

When fatigue is recognized, as a result of inadequate rest or intense concentration, a break in the instruction, or the introduction of maneuvers involving different elements and objectives, may be desirable. Training, which can be absorbed by one student without fatigue, does not necessarily indicate the tolerance of another. Instruction should only be continued if the student is alert and receptive.

➔ *Apathy fostered by poor instruction*

Poor instructor preparation leads to spotty coverage, misplaced emphasis, repetition, and the student's complete lack of confidence. Instruction may be so overly elemental, general, or complicated that the student loses interest.

Poor presentation may result from distracting mannerisms, personal untidiness, or the appearance of irritation. "Talking Down," to the student will cause a lack of confidence and attention.

➔ *Fear, anxiety, or timidity*

Fear, anxiety, or timidity limit the student's perceptive ability. For learning to be effective, the student must be made to feel safe, comfortable, and at ease.

Laws of Learning:

E.L. Thorndike's six **Laws of Learning** summarize the Fundamentals of Learning:

➔ *Law of Readiness*

Individuals learn best when they are ready to learn or are positively motivated. Outside interests, responsibilities, worries, personal problems, or crowded schedules may result in low interest in learning.

➔ *Law of Exercise*

Things most often repeated are best remembered. Every time practice occurs, learning continues.

➔ *Law of Effect*

Learning is strengthened when accompanied by pleasant or satisfying feelings; learning is weakened by unpleasant or dissatisfying feelings. Experiences which produce feelings of defeat, frustration, anger, confusion, or futility are unpleasant. The learning situation should affect students positively and provide satisfaction. Impressing students with the difficulty of the task **can make learning difficult**.

➜ *Law of Primacy*

The first impression is strong. The first experience should be positive, functional, and lay the foundation for all that is to come. What is taught the first time must be correct. What is learned the first time must be correct. Unteaching is more difficult than teaching.

➜ *Law of Intensity*

Vivid, dramatic, exciting learning experiences teach more than routine or boring experiences. Students will gain a greater understanding more quickly by performing rather than observing or using some other performance substitute. The instructor should use **imagination** in approaching reality as closely as possible.

➜ *Law of Recency*

Things most recently learned are best remembered; things least recently learned are least remembered. Carefully prepared summaries of ground school lessons or post flight critiques (debriefings) will restate or emphasize important material.

Common Misconceptions:

Misconceptions, based on partial truths, **traditional** methods, or even sadism and domination, have been erroneously accepted by misguided individuals in the aviation community. Professional instructors should not accept the misconceptions described below.

⇨ Some instructors apply **punishment or threat** in the belief that students can be motivated by fear.

⇨ Some people believe that the mind must be exercised by **unpleasant tasks** or that great physical effort must be expended in order to learn. They feel that making it easier for a student to learn is contrary to sound teaching philosophy.

⇨ It is popular belief that, "one picture is worth a thousand words." According to this theory, the **presentation of an unexplained picture** is more productive than a written or verbal presentation.

⇨ Some teachers believe that the quality of a learning experience depends solely on the **length of the training period**. "More is necessarily better," in their view.

⇨ Some instructors believe that it is necessary to **remain impersonal** in order to be effective. They feel that, "students must be kept in their place," or an attempt will be made to compromise standards.

⇨ Some people believe that **competition** is the key to learning, and that slower learners must fail.

⇨ One educational philosophy preaches

that **students must experience setbacks** and disappointments because failure and frustration is the best preparation for life. Tests should be developed so that no one can pass.

Many of these misconceptions are prevalent, even in recognized institutions of learning, but all have been discredited as effective techniques.

Chapter 5: Human Behavior

Overview:

Knowledge of human needs and defense mechanisms can aid the instructor in promoting a climate conducive to learning.

Defense Mechanisms:

Defense mechanisms are subconscious defenses employed against unpleasant realities. These defenses are used often to soften, or make acceptable, feelings of failure, to alleviate guilt, and to protect feelings of worth or adequacy. The following common defense mechanisms may be used by students:

➔ *Rationalization*

Excuses which are plausible and acceptable to the student for failure or poor performance. This defense is a subconscious justification of that which is unacceptable, but sincerely believed.

➔ *Flight (Escape)*

The student **runs away** from his/her problems. Symptoms include physical or mental ailments and daydreaming. When carried to an extreme, the fantasy world and the real world become confused.

➔ *Aggression*

The best defense is an offense. Anger may be conventionally expressed, but in a classroom, simulator, or aircraft, because of the social structure, aggressiveness may be expressed more subtly by irrelevant questions, refusal to participate, or disruptive activities. Anger may be vented on neutral objects not related to the problem.

➔ *Resignation*

The student becomes so frustrated that he/she gives up or accepts defeat. A common cause of the frustration is the bewilderment associated with being lost in an advanced phase of training because the fundamentals were not grasped.

Student-Instructor Relationship:

To be effective, an instructor must acquire and maintain the student's confidence. The instructor is more than an authority figure. From the student's point of view, the instructor is the expert. Careful preparation of the material and consideration of the student's interests and needs are essential elements in maintaining student confidence.

No two students are alike, and the same methods of instruction will not be equally effective for all students. The **average personality** fits no one. In order to determine the appropriate method of instruction, the student's temperament, background, and interests should be explored.

An instructor, who has **incorrectly analyzed** her/his student, may find that the desired results are not produced. As an example, a student incorrectly analyzed as a slow thinker because of reluctance to act, may actually lack self-confidence. The correct technique would be instruction directed at developing the student's confidence in his/her own capability and judgement, not in drill on the fundamentals of a maneuver.

Students who are having difficulty require instructional methods that combine keen perception and tact. **Slow students** may develop feelings of incompetence with too much help and encouragement. Timid persons may be overwhelmed by too much criticism, but they may rise to the challenge of brisk instruction.

Students who are **discouraged or lack confidence** should be assigned attainable goals. Complex maneuvers can be separated into elements which are mastered before the whole operation is attempted.

Apt students may be challenged by raising the standard of performance progressively.

Students should be made aware of their progress. The failure of an instructor to **communicate** his **evaluation** of the student's progress may block further effective instruction.

With careful preparation, keen analysis, and a continuing deep interest in her/his students, the instructor will provide effective instruction.

Role of the Instructor:

The instructor has the responsibility to make learning interesting and pleasurable. People devote considerable effort to attain the pleasures of self-enhancement and personal satisfaction. People are proud of difficult achievements because they want to feel capable. Students will experience pleasure from a task well done, or from successfully meeting the challenge of a difficult operation. The instructor can maintain a high level of motivation in his/her students without rancor or unpleasantness. A perceptive teacher can make learning an interesting, pleasurable, and rewarding experience.

Sustaining a student's interest can be achieved by pointing out the objectives of each lesson or session. The student will have a goal which will give meaning to the student's efforts. learning should provide an opportunity for the student to build self-confidence and discover her/his capabilities.

Learning should be a period in which correct habit patterns and judgment are developed. The instructor must foster these goals with logical presentation and by example.

The instructor must give credit when it is due. When people perform excellently, they want their abilities and efforts recognized. If there is no note taken, frustration results. Praise from an instructor is an ample reward and an incentive to greater accomplishment. Praise given too freely becomes meaningless.

Criticism must be constructive. Mistakes and failures require identification, but helpful explanations must accompany the critique. It is necessary to be consistent. The same performance accepted at one time, but not at another, serves to confuse and frustrate the student.

No one is expected to be perfect. If the instructor tries to bluff, the student will sense it, and confidence will be destroyed. If you make a mistake, admit it and correct it.

It is generally recognized that instructor qualifications must be based equally on proficiency and teaching ability. The instructor's proficiency must go far beyond that which is required for certification. In order to demonstrate maneuvers or procedures to a student, the instructor's performance should be without faults or deficiencies. The ultimate blow to a student's confidence may be the inability of the instructor to adequately demonstrate.

The habits of the instructor, during his/her instruction, and as he/she is observed conducting other operations, have a vital effect on safety. Each instructor is a paragon of flying to his/her students, who will consciously or unconsciously imitate her/his habits. The instructor's description and advocacy of safety practices becomes meaningless when he/she is observed violating them. Habitual observance of regulations, of safety precautions, and the precepts of courtesy will enhance and support the instructor's professional image.

Qualities of Good Instructors:

Some of the qualities of good instructors are:

☺ They never show favoritism,

☺ They never bluff,

☺ If they don't know the answers to relevant questions they say so, find the answer, and tell the student later,

☺ They are not hasty in judgements,

☺ They understand, and follow, Company policy and procedure,

☺ They acknowledge their own mistakes. The admission that, "you were right and I was wrong," does much to develop morale.

☺ They are decisive. They weigh all factors necessary to make decisions, and then act with conviction.

☺ They are interested in their students and let them know it by being familiar with their backgrounds, problems and achievements. They know how their students are progressing.

☺They respect their students' rights, and when correcting mistakes do so in a straightforward manner, never using sarcasm as a correction method.

☺ They are enthusiastic. Instructor enthusiasm is reflected in student learning.

☺ They use humor. Appropriate

humor creates goodwill and can be used to teach difficult subject material. But they never become so humorous that the business at hand becomes secondary.

☺ They encourage initiative, self-reliance, ideas, and suggestions. By doing so, they teach students to reason for themselves instead of driving them to rigid conformity. However, they stress that there are certain boundaries which must not be overstepped.

☺ They understand that it is important to plan their lessons.

Chapter 6: The Teaching Process

Fundamentals of Teaching:

There are four steps in the teaching process:

➔ *Preparation*

The preparation necessary for each lesson or session includes the instructor's written determination of the material to be covered, the objectives of the lesson or session, the goals which she/he hopes to attain, the procedures and facilities to be used, and the means to be used for evaluating the results. The syllabus may include student home study or other special preparation.

The conscientious instructor does not limit his/her objectives to merely meeting the minimum standards necessary to qualify a student to be competent, efficient, and safe. The plan should provide for the development of the student's **maximum potential**.

➔ *Explanation and Demonstration*

The instructor's presentation of the knowledge and skills required for the lesson or session must be clear, pertinent to the objectives, and based on the experience and knowledge of the student. If a maneuver is to be demonstrated, extraneous activity should be eliminated. Any deviation in performance from that described in the manual or explanation should be immediately explained

➔ *Drill and Practice*

The student's recitation, solving of problems, or performance of maneuvers should be practiced as directed by the instructor. Trial and error, by comparison to directed learning, is inefficient and should not be utilized as a training methodology for flight crew members.

➔ *Review and Evaluation*

Review and evaluation (critique) are integral parts of each lesson, or session. The instructor should review the salient points and the student should be informed of her/his progress. The instructor's evaluation, based upon the objectives and goals established in the syllabus, should be documented as per standard operating procedure.

Developmental Teaching:

Developmental teaching is a student-centered philosophy of teaching which requires instructors to reason with their students to have them arrive at predetermined objectives. Using the student's background knowledge, instructors ask questions which lead the student to determine the next step in a procedure, the logical application of a principle, or the final solution to a problem. The rate of progress in developing the more complex ideas of a lesson or session is governed by the student perception and comprehension. While questions should be asked by the instructor to review previously learned material, developmental teaching begins when students are required to reason out and make suggestions with respect to new material.

Developmental teaching has been used throughout the years by all good teachers. Because of the requirement for every student to participate, developmental teaching is most effective with small groups. It can be used at any level of student knowledge provided that the instructor knows or determines the proper level, and proceeds accordingly. Depending upon the subject matter, some lessons or sessions can be entirely developmental. More frequently, however, there will be a combination of teaching by explanation, where it may be more efficient to explain certain material, and by developmental teaching, where critical areas of the subject matter are reasoned with the students. In almost every lesson or session some developmental teaching is appropriate and desirable.

If developmental teaching technique is new, there may be an initial apprehension about it's use. We may be reluctant to give the students credit for being able to think for themselves. Students consistently surprise instructors if given a chance to participate actively in the learning process. The disadvantage of lecturing during a session briefing is that the students are frequently presented with information that they already know, or that they can reasonably be expected to deduce for themselves. The best teaching occurs when the students are led to a point where they can systematically direct their own reasoning to the solution of problems. The secret of effective learning is to keep the students mentally active in the learning process, and in they are forced into mental activity.

Syllabus:

The training syllabus is the basis for the training curriculum. The order of the training builds upon the previous blocks of instruction and is designed to facilitate the student's progress. Deviation from the syllabus, after approval by the instructor's supervisor, should be documented.

Briefings:

I. There is an *easy way to recall* the briefing process.......

A M O L

The instructor can use "**AMOL**" as a guide when performing briefings (a) or when presenting an item (b) during a briefing.

AIM:

a) the session to be covered with a statement of the new and review work to be covered.

b) a simple statement of the item to be covered.

MOTIVATION:

a) give a concise but brief statement of where the session as a whole fits into the training and why it is important. Keep it general, do not go into specifics about individual maneuvers here.

b) a specific statement of why that particular item is important to learn. Should always be positive, and intrinsic whenever possible.

OUTLINE:

a) give a brief overview of the progression of the briefing. Outline the various sections or stages of the body of the briefing.

b) give the major points of discussion. May be omitted for short topics with only one part.

LINK:

a) relate the topic whenever possible to the student's previous experience. Recent experiences are best.

b) [same as (a), above].

II. *Pocket and Pause:*

After each section of the briefing, pause for a few seconds to allow the student to absorb the material and to think of any questions he/she might have. This also lets the student know that particular section is finished and that a new topic will be commenced.

Oral Quizzing:

Regular and continued evaluation of the student's learning is necessary for judging the effectiveness of the training and for planning the emphasis and pace of subsequent instruction. The most practical means of evaluation is questioning by the instructor. Quizzing by the instructor can have a number of desirable results:

- ➻ Reveals the effectiveness of the instructor's training procedures,
- ➻ Checks the student's retention,
- ➻ Reviews material previously covered,
- ➻ Retains the student's interest and stimulates thinking,
- ➻ Emphasizes important points,
- ➻ Identifies points which need more emphasis,
- ➻ Checks student's comprehension, and
- ➻ Promotes active student participation.

Effective quizzing requires preparation. Good questions are rarely spontaneous. Questions which are ambiguous, not clearly associated with the subject, or do not require specific answers are of little value. Such questions provide little information to the instructor and are confusing and frustrating to the student.

"Catch," questions should be avoided. The student will feel that he/she is in a battle of wits, and the significance of the subject will be lost.

The instructor must be certain that she/he understands a student's question before attempting to answer. The instructor should display interest in the student's question and frame a direct and accurate answer. The instructor should determine that he/she has provided all information required and that the student is satisfied with the answer. If the instructor cannot answer the student's question, available reference should be consulted to provide the answer as soon as possible. "I don't know, but I'll find out as soon as possible," is the **only response** acceptable when the instructor does not have a specific answer to a student's question.

Good Questioning Technique:

a) **Qualities of a Good Question**:

☺ Simple,

☺ Specific,

☺ Correct Wording.

b) **Good Questioning Technique**:

☺ Pose the Question,

☺ Wait for the Answer,

☺ Respond to the Answer.

c) **To Be Avoided**:

☹Questions that Antagonize,

☹ Exposing Ignorance (don't ask a question that you don't think a student can answer),

☹ Vague Questions.

Demonstrations of Ability:

Evaluation of performance during instruction must be based upon established standards modified to account for the student's experience and stage of development. To be meaningful to the instructor, the evaluation must consider the student's mastery of the elements as well as the overall performance. In cases where AIM concepts are a required area of performance, then total interaction with other crew members, etc., will be taken into consideration.

As each maneuver or procedure is accomplished, or during postflight discussion (debriefing),the student should be made aware of her/his progress. Corrections or explanations should define the elements in which the deficiencies occurred, and the appropriate corrective measures should be accomplished. Unless safety of flight is threatened, the correction of student errors should **not** include overriding or taking the controls.

Applying Appropriate Standards:

Students will think, react, or progress differently from one another and in different phases of training. The professional instructor must become familiar with her/his student's thought processes and aptitudes in order to evaluate individual progress during training. The standards for certification may not be modified and all students recommended for certification must meet those standards.

Grading:

The two most common types of grading are the relative and the absolute. When the relative method is used, each student is rated against others in the group or time frame. When the absolute method is used, only the actual quality of performance, as measured against the standard, is considered.

There are several common errors which instructors make in grading their student's performances. They are:

☹ *Error of Central Tendency*

Many instructors hesitate to give either extremely high or extremely low grades. They tend to group their ratings close to the center of the grading scale. If an error of central tendency is taking place, true ability is not reflected on the syllabus pages and, therefore, the grade is of little value.

☹ *Error of Standards*

Some instructors tend to overrate or underrate everyone in comparison to the ratings of most other instructors. They have different personal standards. This type of error should be corrected during the annual proficiency sessions.

☹ *Logical Error*

Instructors who have a logical error allow the performance of one item to influence their rating of another item which they associate with the first by logical connection. An unsatisfactory Take-off briefing, for example, might be extended to a logical error that the entire Take-off phase was unsatisfactory. The alert instructor should grade each maneuver separately and objectively.

☹ *Error of Familiarity*

When instructors see the same students every day for a number of weeks, they can lose their grading objectivity. They become accustomed to the student's weaknesses or eccentricities and overlook them as errors because they have become familiar with them. Anything that can be done to step back and get a new perspective will help avoid this type of error.

☹ *Error of Halo*

Many instructors tend to assign grades after being influenced by their general impression of the student. An instructor may like or dislike a student because of something that has been said or done, or because of his/her nationality or background, and this feeling often influences the grading pro or con.

☹ *Error of Narrow Criterion*

This error is sometimes made by new instructors who use the two students they have at the moment as though they represented the whole range of proficiency. For example, if both are superior students, the weaker of the two is graded as barely satisfactory if an error of narrow criterion is being made.

☹ *Error of Delayed Grading*

If the grading is separated long enough from the actual performance for information about the performance to be forgotten, then the grade is in error. If this happens, the instructor will often go to the central tendency type of grading because of lack of pertinent information to justify extreme ratings. Another possibility is that the session will stand out in the instructor's mind, and the forgotten material will be rated according to this lingering impression.

Accurate grading is necessary in any training progress if the process is to be validated and standardization (quality control) maintained. This accuracy is difficult to achieve because numerous individuals of varying experience are involved; however, instructors must be aware of the error tendencies and do their utmost to ensure that those errors are not occurring in their grading.

Chapter 7: Instructor Responsibilities

Overview:

The correct performance of the instructor's responsibilities are of vital importance to the student's future performance and safety.

➔ *Instruction of students*

The basic and most important responsibility of the instructor is to provide the necessary ground, simulator or aircraft instruction.

➔ *Student supervision and surveillance*

It is the instructor's responsibility to correct observed unsatisfactory performance by the most reasonable and effective means. If the instructor is unable to correct the situation personally, the situation must be reported to higher authority for action.

➔ *Acceptance of the student*

The professional instructor must accept the student with his/her faults and problems. The student wants to learn, and the instructor makes her/himself available to assist in the process. The professional relationship of the instructor to his/her student must be based on the mutual acknowledgement that each is important to the other, and that both are working for the same objective.

➔ *Language and Culture*

The professional instructor must speak normally, clearly, distinctly, and without inhibition. She/he must cultivate the ability to speak positively and descriptively without diverting the student's ability to comprehend.

The instructor must pay careful attention to the usage of idiom, sarcasm and humor, especially when dealing with a student whose primary language is different that his/her's. In the same context, special attention must be focused on specific cultural norms in students from different cultural backgrounds. Any questions in these areas should be directed to supervisory personnel.

➔ *Self-improvement*

The professional instructor must never become complacent or satisfied with her/his qualifications or ability and must constantly strive to improve his/her qualifications, effectiveness, and the services which she/he provides. The instructor is considered an authority on aeronautical matters and is the expert to whom many questions are referred.

Aviation symposiums, FAA sponsored seminars and standardization meetings are three of many sources for continuing education. Opportunities are presented for the exchange of information with instructors from other companys and areas. Aviation periodicals, government publications, technical magazines, and in-house safety files and training bulletins are sources of valuable information.

For a professional performance, it is essential that the instructor be familiar with, and in some cases maintain, the pertinent Flight Operations Manuals, Federal Air Regulations, Airman's Information Manual, Training and Standardization Memos, as well as airline (specific) directives, SOPs and memos.

Chapter 8: Conclusions

Strive to constantly keep a professional attitude towards the work and its challenges. Cultivate the social attributes of tact, sympathy, and patience. At all times project the instructor/check airman image. Be sincere, calm, disciplined, and objective. Be noted for your stability of temperament and a marked capacity for self control. Follow the rules yourself; keep the respect of your colleagues; operate by the book. In all your instruction:

- ✈ **PLAN AHEAD**
- ✈ **HAVE A TARGET**
- ✈ **KEEP IT SIMPLE**
- ✈ **KEEP THE OBJECTIVE CLEAR & ATTAINABLE**

Reference List

"Advanced Qualification Program." (1991). U.S.Department of Transportation, Federal Aviation Administration Advisory Circular 120-54. Washington, D.C.

Aviation Instructor's Handbook. (1977). U.S. Department of Transportation, Federal Aviation Administration Advisory Circular 60-14. Washington, D.C.

Biggs, J.B. (1979). "Individual Differences in Study Processes and the Quality of Learning Outcomes," Higher Education, vol 8.

__________ (1985). "The Role of Metalearning in Study Processes." British Journal of Educational Psychology, vol 55.

__________ (1987). Student Approaches to Learning and Studying. Hawthorne, Victoria: Australian Council for Educational Research.

"Certification: Pilots and Flight Instructors." (1991). U.S. Department of Transportation Federal Aviation Administration Advisory Circular 61-65C. Washington, D.C.

"Company Check Pilot Manual of Transport Canada." (March, 1994). Transport Canada Aviation. TP 6533E, rev 4. Toronto, Canada.

"Embry-Riddle Flight Instructor Refresher Clinic Agenda." (February 24-26, 1989). Daytona Beach, Florida.

__________. (February 22-24, 1991). Daytona Beach, Florida.

Federal Register. (October 2, 1990). "Advanced Qualification Program; Final Rule." 14 CFR Parts 61, et al. U.S. Department of Transportation Federal Aviation Administration. Washington, D.C.

Flight and Ground Instructor Written Test Book: FAA-T-8080-18A. (1993). US Department of Transportation: Federal Aviation Administration. Washington, DC.: US Government Printing Office.

Flight Instructor Manual. (1991). Englewood, CO: Jeppesen Sanderson, Inc.

"Flight Training Manual: Airbus Service Company, Inc. Training Center - Miami." (1995). Chapter 5.

Gleim, Irvin N. (1994). Flight/Ground Instructor: FAA Written Exam. Gainesville, Florida: Gleim Publications.

______________ (1994). Fundamentals of Instructing: FAA Written Exam. Gainesville, Florida: Gleim Publications.

Harris, Joel S. (1994). "The Pilot's Efforts Determine Simulator Training Value." Flight Safety Foundation Helicopter Safety.

Hawkins, Frank H. (1993). Human Factors in Flight, 2d ed.. Brookfield, Vermont: Ashgate.

Hughes, David. (January 16, 1995). "FAA May Make AQP Mandatory." Aviation Week and Space Technology.

"Interactive Preflight." (February, 1995). Flight Training.

Jarvis, P. (1987). Adult Learning in the Social Context. London: Croom Helm.

Kirby, J.R., Moore, P.J. and Schofield, N.J. (1988). "Verbal and Visual Learning Styles," Contemporary Educational Psychology, vol 13.

Law, J. Randolph, Robert L. Helmreich and John A. Wilhelm. (July, 1994). "Key Ingredients of High Quality LOFT: A Recipe for Effective Pilot Training." The CRM Advocate. Charlotte, N.C.: Resource Options, Inc.

Rolfe, J.M. and K. J. Staples, eds. (1991). Flight Simulation. Cambridge, England: Cambridge University Press.

Searmans, James and Thomas F. Walby. (1986). The Managers' Manual: SOP for Flight Operations. Miami, FL: Eastern Airlines, Inc.

Shlechter, Theodore M., ed. (1991). Computer-Based Training. Norwood, NJ: US Army Research Institute for the Behavioral and Social Sciences, and Ablex Publishing Corp.

"Takeoff - The Airline Story" [Video Tape]. (1979). Embry-Riddle Aeronautical University Video Library, item #219. Daytona Beach, Florida.

Telfer, Ross A., ed. (1993). Aviation Instruction and Training. Brookfield, VT: Ashgate Publishing Co.

Watkins, D. and Hattie J. (1990). "Individual and Contextual Differences in the Approaches to Learning of Australian Secondary School Students." Educational Psychology, vol. 10.

Wiener, Earl L. & D. C. Nagel. (1988). Human Factors in Aviation. San Diego, CA: Academic Press.

Bibliography

Adams, J.A. (1968). "Response Feedback and Learning." Psychological Bulletin. 70, p 486 - 504.

__________ (1987). "Historical Review and Appraisal of Research on the Learning, Retention and Transfer of Human Motor Skills." Psychological Bulletin. 101(1), p 41-74.

"Advanced Qualification Program." (1991). U.S.Department of Transportation, Federal Aviation Administration Advisory Circular 120-54. Washington, D.C.

Allen, W.H. (1960). "Audio-Visual Communication." Encyclopedia of Educational Research, 3rd.ed. (Ed. by C.W. Harris). New York: MacMillan.

Anderson, J.R. (ed) (1981). Cognitive Skills and Their Acquisition. Hillsdale, NJ: Lawrence Erlbaum.

_____________ (1987). "Skill Acquisition: Compilation of Weak-Method Problem Solutions." Psychological Review, 94, p 192 - 210.

Annett, J. (1961). "The Role of Knowledge of Results in Learning: A Survey," Report No. 342-3. New York: US Training Devices Center.

_________ (1969). Feedback and Human Behavior. Harmondsworth: Penguin.

Annis, L.F. (1983). "The Process and Effects of Peer Toutoring." Human Learning. Dubuque: Wm. C. Brown.

Anzai, Y. and Simon, H.A. (1979). "The Theory of Learning by Doing." Psychological Review. 86, p 124 - 140.

Arons, A.B. (1984). "Computer-based Instructional Dialogs." Science. Vol 224.

Aviation Instructor's Handbook. (1977). U.S. Department of Transportation, Federal Aviation Administration Advisory Circular 60-14. Washington, D.C.

Biggs, J.B. (1979). "Individual Differences in Study Processes and the Quality of Learning Outcomes," Higher Education, vol 8.

__________ (1985). "The Role of Metalearning in Study Processes." British Journal of Educational Psychology, vol 55.

__________ (1987). Student Approaches to Learning and Studying. Hawthorne, Victoria: Australian Council for Educational Research.

Bork, A. (1981). Learning and Computers. Bedford, Mass: Digital Press.

Bransford, J.D. (1979). Human Cognition: Learning, Understanding, and Remembering. Belmont, CA: Wadsworth.

Briefing Plan: GLPLAN1. (1993). Toulouse, France: Aeroformation, The Airbus Training Organization.

Briggs, L.J. and Waters, W.W. (1981). Handbook of Procedures for the Design of Instruction, 2d ed. Englewood Cliffs, NJ: Educational Technology Publications.

Brostrom, R. (1979). "Training Style Inventory (TSI)." The 1979 Annual Handbook for Group Facilitators. Ed. by Jones, J.E. and Pfeiffer, J.W. San Diego, CA: University Associates.

"Certification of Training Centers." (1994). U.S. Department of Transportation Federal Aviation Administration Advisory Circular 142-1. Washington, D.C.

"Certification: Pilots and Flight Instructors." (1991). U.S. Department of Transportation Federal Aviation Administration Advisory Circular 61-65C. Washington, D.C.

Cole, M.J., Cay, J. and Sharp, D.W. (1971). The Cultural Context of Learning and Thinking. New York: Basic Books.

"Company Check Pilot Manual of Transport Canada." (March, 1994). Transport Canada Aviation. TP 6533E, rev 4. Toronto, Canada.

Davis, B.G., Wood, L. and Wilson, R.C. (1983). ABC's of Teaching with Excellence. Berkley, CA: University of Califirnia.

Dillon, J.T. (1983). Teaching and the Art of Questioning. Bloomington, Indiana: Phi Delta Kappa Educational Foundation.

"Embry-Riddle Flight Instructor Refresher Clinic Agenda." (February 24-26, 1989). Daytona Beach, Florida.

___________. (February 22-24, 1991). Daytona Beach, Florida.

Farrow, Doug. (1993). "Developing Generic Instructor and Evaluator Task Listings for AQP Curriculums." Dulles Airport, VA: ATA AQP Working Group, Instructor and Evaluator Focus Group.

Federal Register. (October 2, 1990). "Advanced Qualification Program; Final Rule." 14 CFR Parts 61, et al. U.S. Department of Transportation Federal Aviation Administration. Washington, D.C.

Flight and Ground Instructor Written Test Book: FAA-T-8080-18A. (1993). US Department of Transportation: Federal Aviation Administration. Washington, DC: US Government Printing Office.

Flight Instructor Manual. (1991). Englewood, CO: Jeppesen Sanderson, Inc.

"Flight Training Manual: Airbus Service Company, Inc. Training Center - Miami." (1995). Chapter 5.

Gay, G. (1986). "Interaction of Learner Control and Prior Understanding in Computer Assisted Video Instruction." Journal of Educational Psychology, Vol 78.

Gleim, Irvin N. (1994). Flight/Ground Instructor: FAA Written Exam. Gainesville, Florida: Gleim Publications.

______________ (1994). Fundamentals of Instructing: FAA Written Exam. Gainesville, Florida: Gleim Publications.

Harris, Joel S. (1994). "The Pilot's Efforts Determine Simulator Training Value." Flight Safety Foundation Helicopter Safety.

Harter, S. (1978). "Effective Motivation Reconsidered: Toward a Developmental Model." Human Development, vol 21.

Hawkins, Frank H. (1993). Human Factors in Flight, 2d ed. Brookfield, Vermont: Ashgate.

Hughes, David. (January 16, 1995). "FAA May Make AQP Mandatory." Aviation Week and Space Technology.

"Interactive Preflight". (February, 1995). Flight Training.

Ivancevich, John M., and William F. Glueck. (1989). Foundations of Personnel - Human Resources Management, 4th ed. Homewood, Illinois: BPI-Irwin.

Jackson, Cynthia L. (Winter 1994). "Adutl Pedagogy: A Contradiction in Terms." The Network. The Union Institute, Vol 12, Number 2 .

Jarvis, P. (1987). Adult Learning in the Social Context. London: Croom Helm.

Kelley, C.R. (1969). "What is Adaptive Training?" Human Factors. vol 11.

Kirby, J.R., Moore, P.J. and Schofield, N.J. (1988). "Verbal and Visual Learning Styles," Contemporary Educational Psychology, vol 13.

Knowles, M. (1984). The Adult Learner: A Neglected Species,3d.ed. Houston, TX: Gulf.

Kolb, D.A. (1976). Learning Style Inventory: Technical Manual. Boston: McBer.

Law, J. Randolph, Helmreich, Robert L. and Wilhelm, John A. (July, 1994). "Key

Ingredients of High Quality LOFT: A Recipe for Effective Pilot Training." The CRM Advocate. Charlotte, NC: Resource Options, Inc.

Lepper, M.R. and Malone, T.W. (1985). "Intrinsic Motivation and Instructional Effectiveness in Computer-Based Education." Aptitude, Learning and Instruction:III. Conative and Affective Process Analysis. Ed. by R.E. Snow and M.J. Farr. Hillsdale, NJ: Erlbaum.

Lintern, G. and Roscoe, S.N. (1980). "Adaptive Perceptual-Motor Training." Aviation Psychology, ed by S.N. Roscoe. Ames, Iowa: Iowa University Press.

Marton, F., Hounsell, D. and Entwistle, N., eds. (1984). The Experience of Learning. Scottish Academic Press: Edinburgh.

McClelland, D.C. (1985). Human Motivation. Glenville, Illinois: Scott & Foresman.

McKeachie, Wilbert J. (1986). Teaching Tips: A Guidebook for the Beginning College Teacher. Lexington, Mass: D.C. Heath and Co.

Patrick, J. (1992). Training: Research and Practice. San Diego, CA: Academic Press.

Peters, Tom (1987). Thriving on Chaos. New York: Alfred A. Knoph, Inc.

"The Qualified Flying Instructor: A-12-139-002/PF-DOO (Annex A)." (1992). Moose Jaw, Sask: The Canadian Forces Flying Instructor School.

Rolfe, J.M. and Staples, K.J., eds. (1991). Flight Simulation. Cambridge, England: Cambridge University Press.

Searmans, James and Thomas F. Walby. (1986). The Managers' Manual: SOP for Flight Operations. Miami, FL: Eastern Airlines, Inc.

Schwartz, Douglas. (1990). "Human Factors Applications to the Training of Flight Crews: The Next Generation of Cockpit Resource Management (CRM) Training." Presented to: The ICAO Human Factors Seminar, Leningrad, USSR.

Shlechter, Theodore M., ed. (1991). Computer-Based Training. Norwood, NJ: US Army Research Institute for the Behavioral and Social Sciences, and Ablex Publishing Corp.

Sirois, Jason. (1993). "Self Diagnosis of your Personal Teaching Style." Toulouse, France: RH Partners.

"Takeoff - The Airline Story" [Video Tape]. (1979). Embry-Riddle Aeronautical University Video Library #219.

Telfer, Ross A., ed. (1993). Aviation Instruction and Training. Brookfield, VT: Ashgate Publishing Co.

Thorndike, E.L. (1903). Educational Psychology. New York: Leincke and Buechner.

_______________ (1927). "The Law of Effect." American Journal of Psychology. Volume 39.

"Training the Trainer." (1994). A Seminar Presented by Fred Pryor. Fort Lauderdale, FL.

TUTOR Jet Instructor Pilot-Basic Training (A-P8-032-114/PC-DO2). (1992). Winnipeg: Canadian Air Command Headquarters, Chief of Staff Personnel and Training.

Walby, Thomas F. (1994). "Initial Instructor Training at the Airbus Training Center-Miami: A Syllabus." Miami: Airbus Industrie, N.A.

Watkins, D. and Hattie J. (1990). "Individual and Contextual Differences in the Approaches to Learning of Australian Secondary School Students." Educational Psychology, vol. 10.

Wheeler, M. and Marshall, J. (1986). "The Trainer Type Inventory (TTI): Identifying Training Style Preferences." The 1986 Annual for Facilitators, Trainers and Consultants. Ed. by Goodstein, L.D. and Pfeiffer, J.W. San Diego, CA: University Associates.

Wiener, Earl L. & Nagel, D.C. (1988). Human Factors in Aviation. San Diego, CA: Academic Press.

Index

Page