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Scenario Based Training in an Aviation Training Environment

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SCENARIO BASED TRAINING
IN AN AVIATION TRAINING ENVIRONMENT

by

Brenda Cox

A Research Project Presented in Partial Fulfillment
of the Requirements for the Degree
Master of Education

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ABSTRACT

Scenario Based Training In an Aviation Training Environment

Trends in aviation training (i.e., the changes in pilot instruction proposed by the industry training standards represent changes in the content and delivery of pilot instruction) indicate a shift from traditional maneuver based training approach to incorporate training that is scenario based, which requires different skills and competencies. In this project, the author attempted to solve this problem by designing a PowerPoint presentation of strategies and techniques that pilot instructors new to the operational training environment can utilize when teaching scenario based training (SBT). The strategies are based on methods and techniques utilized by instructors/researchers who have spent years in the field of aviation education researching topics such as how to develop, implement, or manage SBT in an aviation operational environment.

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Chapter 1

INTRODUCTION

According to Robertson, Schumacher, and Petros (2005), learning is enhanced when training is realistic. In addition, the underlying skills needed to make good judgments and decisions are teachable. The training staff of the military, as well as commercial airlines, has embraced these principles through the integration of Line Oriented Flight Training (LOFT) and Crew Resource Management (CRM) training into their qualification programs (Robertson et al.). In both LOFT and CRM lessons, real life scenarios are utilized as a means to expose pilots to realistic operations and critical decision making opportunities. The most notable shift in these programs is that, currently, they are scenario based. When the instructor is a facilitator, not the lecturer, classes are more interactive.

Statement of the Problem

Aviation instructors have to assume a new role and function, based on a different set of rules, policies, and procedures in an aviation training environment. Between June 1994 and May 1995, Dismukes, McDonnell, and Jobe (2000) interviewed instructors from five major U.S. airlines. Of the instructors interviewed during this study, several instructors volunteered that they did not feel adequately trained to facilitate LOFT scenario based training. Facilitation, especially because it is a radical departure from the instructional techniques traditionally used in aviation, requires hands-on training in which

instructors: (a) observe expert facilitators, (b) practice facilitation, and (c) receive feedback.

The findings from the Dismukes et al. (2000) study supported previous research (Dismukes et al., 1997; Continental Airlines, 1992; both cited in Dismukes et al.) findings, that is, facilitation can be an effective tool to increase the depth of crew participation and self-analysis of CRM performance. In this study, instructor facilitation skill varied dramatically, which suggested a need for more professional development (e.g., hands-on training in facilitation techniques). It is both beneficial and necessary that instructors be provided with information that bridges the gap between their knowledge and training skills.

Purpose of the Project

The purpose of this project was to create a presentation, based on adult learning strategies, for pilot instructors to be able to effectively facilitate scenario based training. This presentation is designed for pilot instructors in the aviation industry. The strategies and techniques used in the presentation model are those which are identified as best practices in an aviation training environment.

Chapter Summary

An outline of the background research, statement of the problem, and the purpose of the project were presented in this chapter. In Chapter 2, the review of literature, the author reviews the current literature available on problem (scenario) based learning and adult learning principles to support the development of the effective strategies and techniques.

Chapter 2

REVIEW OF LITERATURE

The purpose of this project was to create a presentation based on adult learning strategies, for pilot instructors to be able to effectively facilitate scenario based training. Those individuals who are involved in the aviation industry are moving from traditional knowledge-related learning outcomes to an emphasis on increased internalized learning in which learners assess situations and react appropriately (Federal Aviation Administration [FAA], 2008). Knowledge components become an important element of a dynamic learning experience. Also, the development of advanced avionics have contributed to a shift in the focus of aviation training to include aeronautical decision-making (ADM) and risk management.

The FAA (2008) researchers stated that “scenario based training (SBT) is based on the concept of situated cognition, which is the idea that knowledge cannot be known and fully understood independent of its context” (p. 11) In other words, humans learn better when the situation is more realistic and they are expected to perform.

Scenario based training is a compilation of basic learning theory, adult learning concepts, and the best of the traditional aviation training procedures (FAA, 2008). Above all, it is about learning complex tasks in a realistic environment at a pace and in a structure the individual student can comprehend and process. Good teaching techniques are still important, but only if they aid in student learning.

To become an effective instructor, which in turn produces effective training, the instructor needs to have background knowledge about basic learning theory and adult learning concepts. Most of the research in the field of training is geared toward professionals with backgrounds in education. The purpose of this project was to create a presentation for aviation instructors designed to help them understand adult learning concepts. This presentation includes those strategies that are best practices for instructors in an aviation training environment.

Simulation and Aviation

Since the conception of manned flight, pilot training has been an important issue. Flying is a difficult, complex task that requires considerable attention resources from the pilot as well as extended training (Wickens, Lee, Liu, & Becker, 2004). Flight training devices (i.e., simulator and virtual environment) have long been a notable resource to minimize both the costs and dangers which are associated with learning to fly. The use of these devices has supported training programs in other areas in aviation such as air traffic management. Many simulation devices utilize the latest computers and technology (i.e., they replicate detailed terrain, equipment failures, motion, vibration, and visual cues about a situation). Also, the use of simulation has been a focal point in training research, in that, a controlled environment is provided where experiments may be conducted to determine the effectiveness of various training methods.

Simulation can be defined through numerous viewpoints; yet, according to Hays and Singer (1989, as cited in Blickensderfer, Liu, & Hernandez, 2005), simulation is the representation of components of an environment through some medium in order to achieve an objective. In the case of flight training, the objective is to use the simulator to

allow the learner to practice the fundamentals of flying an aircraft without flying an actual aircraft. Aircraft simulators range from desktop computers to full size replicas of specific makes, models, and series of airplane cockpits (i.e., flight management software and hardware). The FAA (1991) is the chief authority to certify these devices for training purposes in the United States.

Standards and Regulations

According to a FAA (1991) representative, the FAA has served as a regulatory force behind the use of simulators in aviation training. Staff of the FAA has provided guidelines for training programs as well as standards that individual simulators must meet in order for pilots to receive credit for their training. Each simulator is classified through a series of levels (i.e., A, B, C, D, and level six), which represent the complexity of the simulation systems. Not all simulators are required to have the highest and most advanced technologies; each training program may acquire and certify simulators from different levels in order to meet their training need. The characteristic is that simulators, at all levels, are able to replicate certain aspects of an aircraft, and that training provided in the simulator is effective.

Simulation and Flight Training

According to Hays, Jacobs, Prince, and Salas (1992), flight training simulators are effective educational and instructional tools. Two main benefits of their use are safety and costs. Duncan and Feterle (2000, as cited in Blickensderfer et al., 2005) added that the use of simulators increase safety because they can train pilots under conditions that would be too dangerous to train in actual instruction. For example, pilots who need to develop the knowledge and skills necessary to fly during stormy weather no longer need

to wait for a cloudy day; they can practice in simulated conditions in the flight training device with no threat to themselves or the aircraft. The simulator is an excellent classroom because the student is able to make mistakes and learn from them (Garrison, 1985, as cited in Blickensderfer et al., 2005). Also, the instructor pilot is allowed to focus on teaching and not flying the aircraft. Additionally, many simulators have the capability to collect data during the training scenarios that can be reviewed later by both the student and instructor.

In addition to practicing basic tasks (e.g., stick and rudder) in a simulator, pilots and crew can practice other flight related skills as well. Pohlman and Edwards (1993) studied the usefulness of desktop simulators to train for procedural tasks. In their studies, students learned how to program a weapon program on an F-16 more quickly in a simulator than in a conventional training setting.

Crew coordination and decision making training are two other important types of skills practiced in simulators (Blickensderfer et al., 2005). The simulator is an excellent environment for this type of training because high physical fidelity is not needed to produce effective results (Connolly, Blackwell, & Lester, 1989, as cited in Blickensderfer et al.). Cockpit Resource Management (CRM) training has been a vital safety concern in most airlines (Caro, 1988, as cited in Blickensderfer et al.). This type of training is focused on how aircrews work together and interact with one another, as well as how to make effective use of all resources available to them (Duncan & Feterle, as cited in Blickensderfer et al.). Cockpit resource management programs have been implemented successfully via simulator based training programs, and simulation based training has also been effective in the initial stages of pilot training.

What Is Teaching?

Teaching is to instruct or train someone or it may be the profession of someone who teaches. Someone who teaches is, of course, a teacher or, for the purposes of this project, an instructor. Measured by number of people in the profession, teaching is one of the largest professions in the world. To be a teacher implies that one: (a) has completed some type of formal training, (b) has specialized knowledge, (c) has been certified or validated in some way, and (d) adheres to a set of standards of performance (FAA, 2008). According to Erickson (1995, as cited in FAA, 2008), good teachers: (a) select and organize worthwhile course material, (b) lead students to encode and integrate this material in memorable form, (c) ensure competence in the procedures and methods of a discipline, (d) sustain intellectual curiosity, and (e) encourage independent learning.

Effective Instructor: Skills Needed

Much research has been devoted to trying to discover what makes a good or effective instructor (FAA, 2008). According to the FAA (2008) researchers, effective instructors come in many forms but, generally, they possess four essential teaching skills: (a) people skills, (b) subject matter expertise, (c) management skills, and (d) assessment skills.

People Skills

People skills are the ability to interact, talk, understand, empathize, and connect with people. Effective instructors relate well to people. Effective communication underlies people skills (FAA, 2008).

Also, people skills include: (a) the ability to interact respectfully with learners, (b) motivate students to learn, and (c) adapt to the needs of the learner when necessary

(FAA, 2008). Another important people skill used by effective instructors is to challenge students intellectually while their efforts to learn are supported. The willingness to look for ways to match student learning styles to personal instructional style is another element of effective instruction (FAA, 2008).

Subject Matter Expertise

A subject matter expert (SME) is a person who possesses a high level of expertise, knowledge, or skill in a particular area. Effective instructors are not only knowledgeable about aviation; also, they are knowledgeable about teaching (FAA, 2008). As mentioned earlier, possession of a high level of technical knowledge does not equate to the ability to teach it. An effective instructor possesses a strong motivation to teach, as well as a positive attitude toward learning. The study of how people learn has been ongoing for almost 100 years.

Management Skills

In general, management skills include the ability to plan, organize, lead, and supervise (FAA, 2008). For the effective instructor, these skills are reflected in the ability to plan, organize, and carry out a lesson. A well planned lesson means the instructor is also practicing time management skills and ensures the time allocated for the lesson is well used.

Assessment Skills

Assessment of learning is a complex process, and it is important to be clear about the purposes of the assessment (FAA, 2008). There are several points at which assessments can be made: (a) before training, (b) during training, and (c) after training (FAA, 2008).

Teaching Methods

According to Kerka (1992), modern learning theories underlie new teaching methods, which facilitate learning judgment, critical thinking, and decision making. The findings from Kerka's cognitive research provided a better understanding of how people learn and how they solve problems, from which new teaching strategies emerge. A closer look at the teaching practices, methods, strategies, and techniques is necessary in order to understand how to implement the strategies and methods to teach higher order skills: (a) aeronautical decision making, (b) situational awareness, and (c) critical thinking in aviation.

A teaching method must be selected before the training intervention is planned (FAA, 2008). To be an effective instructor, it is important to determine which teaching methods best convey the information being taught (FAA, 2008).

Problem Based Learning Instruction

In 1966, at the McMaster University School of Medicine in Canada, a new approach to teaching and curriculum design was pioneered and termed, problem based learning (PBL; FAA, 2008). In PBL, the focus of learning has shifted from an instructor centered approach to a learner centered approach. There are many definitions for PBL, but for the purposes of this project, it is defined as the type of learning environment in which lessons are structured in such a way as to confront learners with problems encountered in real life that force them to reach real world solutions.

Problem based learning starts with a carefully constructed problem to which there is no single solution (FAA, 2008). The benefit of PBL is to help the learner understand the information and improve his or her ability to recall the information. This results

when the material is presented as an authentic problem in a situated environment that allows the learner to *make meaning* of the information based on his or her past experience and personal interpretation. This type of problem encourages the development of higher order thinking skills (HOTS), which include cognitive processes such as problem solving and decision making, as well as the cognitive skills of: (a) analysis, (b) synthesis, and (c) evaluation. Three types of problem based instruction are discussed: (a) scenario based (b) collaborative problem-solving, and (c) case study.

Scenario Based Training Method

A series of aviation education specialists have offered their definitions on the subject of scenario based training (FAA, 2008). Scenario based training (SBT) is a training method that uses a highly structured script of real world experiences to address aviation training objectives in an operational environment. Such training can include: (a) initial training, (b) transition training, (c) upgrade training, (d) recurrent training, and (e) special training. The goal of SBT is to challenge the student with a variety of flight scenarios designed to improve decision making skills. These scenarios require the pilot to: (a) manage the resources available in the flight deck, (b) exercise sound judgment, and (c) make timely decisions. Although flight instructors have used the SBT approach as a teaching method for many years, the recent emphasis on SBT in aviation training reflects the findings from aviation researchers that demonstrate that learners learn more effectively when actively involved in the learning process.

Oser, Cannon-Bowers, Salas, and Dwyer (1999) defined SBT as different from traditional classroom training, in that, a scenario or exercise serves as the curriculum. The overall goal is to provide specific opportunities for the learner to develop critical

competencies (i.e., operator knowledge, skills, and attitudes) through practice and feedback.

Cannon-Bowers, Burns, Salas, and Pruitt (1998) described SBT as training that is focused on well planned exercises, with feedback provided to learners based on their responses to simulated cues comparable to those in the actual work environment. Specifically, SBT differs from traditional methods, as the scenarios comprise the entire curriculum from the beginning.

Salas, Priest, Wilson, and Burke (2006) offered another perspective for the definition of SBT. Scenario based training is rooted in scientific theories of learning and progressively builds from the presentation of information (i.e., declarative and procedural knowledge) in a traditional manner (e.g., classroom lectures, self-paced, computer-based, and multimedia learning) to demonstrations where the learners can observe the performance targeted for training, to practice based methods where the scenarios become the curriculum. Practice activities become the content of training.

The aviation instructor is the key to successful SBT, and the overall learning objective in this method of training delivery is for the student to be more ready to exercise sound judgment and make good decisions (FAA, 2008). The scenario may not have one right or one wrong answer, which reflects situations faced in the real world. It is important for the instructor to understand in advance which outcomes are positive and/or negative and allow the student freedom to make both good and poor decisions without jeopardizing safety. This allows the student to make decisions that fit his or her experience level and result in positive outcomes.

According to Lauber and Foushee (1981), Line Oriented Flight Training (LOFT) is a type of SBT that refers to aircrew training and involves the simulation of realistic, full mission situations. These situations, or scenarios, consist of typical daily operations for the airline and are often developed from accident reports to enhance realism. Realistic problems and emergencies are introduced during the scenarios to train correct flight deck management techniques.

Collaborative Problem Solving Method

Collaboration (i.e., two or more people working together) to solve problems has been used throughout time (FAA, 2008). In education, the collaborative problem solving method combines collaboration with problem solving when the instructor provides a problem to a group who then solves it. This method uses collaboration and can be modified for an interactive one-on-one learning situation such as an independent aviation instructor might encounter. The instructor provides the problem to the student, offers only limited assistance as the student solves it, but participates in finding solutions. Once again, open-ended *what if* problems are used to provide the students with an opportunity to develop HOTS.

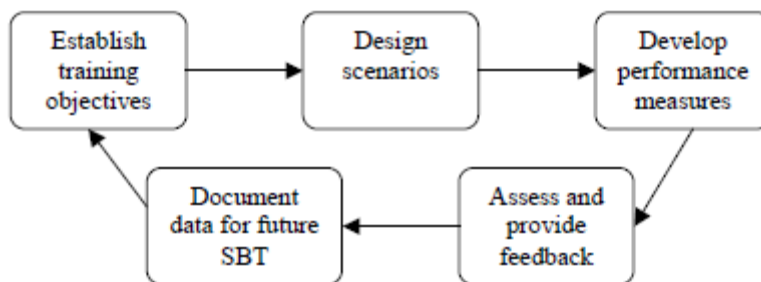
Case Study Method

A case study is a written or oral account of a real world situation that contains a message that educates the student (FAA, 2008). An increasingly popular form of teaching, the case study contains a story relative to the learners that forces them to deal with situations encountered in real life. The instructor presents the case to the learners who: (a) then analyze it, (b) come to conclusions, and (c) offer possible solutions. Effective case studies require the learner to use critical thinking skills.

The Scenario Based Training (SBT) Process

Oser et al. (1999) designed a systematic SBT model, based on basic principles of learning, as shown in Figure 1. This approach guides training designers and/or instructors to: (a) identify the task/mission and the knowledge, skills, and abilities involved; (b) design scenarios to include events which allow the learner to develop and practice the specific knowledge, skills, and abilities identified; (c) design performance measures to enable the trainer to assess performance; and (d) ensure that specific feedback is given to the learner.

Figure 1. Scenario based training model, adapted from Oser et al., 1999.



There are four phases within the Oser et al. model. The first phase is to identify learning or training objectives (i.e., the knowledge and skills necessary to perform a specific task). Usually, training objectives are based on a need for improvement and/or the introduction of unfamiliar equipment. The second phase is to plan scenario events, which will give the learner the opportunity to practice the desired skills. The scenarios are based on the training objectives. If planned carefully, and correctly, the events ensure that the learner practices all of the targeted skills until all training objectives are met (Cannon-Bowers et al., 1998). The third phase is performance assessment. Performance measures are developed which link closely to scenario events and allow the instructor to evaluate

whether the learner has demonstrated the correct knowledge and skills (Oser et al.). Once the learning objectives, scenario events, and performance measures are developed, it is time for the learner to experience the scenario. During this time, the instructor monitors the learner performance and uses the performance criteria to judge learner performance. The final phase is feedback/debrief; the instructor gives specific, detailed feedback to the learner. The instructor links the feedback to specific events and learning objectives. This helps the learner to interpret the feedback and, in turn, to integrate the feedback into his/her subsequent performance.

The purpose of the Oser et al. (1999) model is to help training developers and instructors organize their approach to design and implement SBT. Also, it can help to guide the process which defines a set of features or attributes that must be present in order to ensure that the training is effective.

Training Effectiveness: An Overview

There is strong consensus that acquisition of knowledge, skills, behaviors, and attitudes through training is of little value if the new characteristics are not generalized to the job setting and are not maintained over time (Kozlowski & Salas, 1997, as cited in Yamnill & Mclean, 2001). In other words, training is useless if it cannot be translated into performance. According to Swanson (1995), for human resources development (HRD) to become a core business process, performance is the key.

Definition of Training

Tuijnman (1996) defined training as the provision that is aimed at creating intentional learning processes that contribute to improving the performance of workers in their present job. The definition does not differ notably from definitions of training in the

HRD context. For instance, in an HRD environment, training is often defined as a planned learning experience designed to bring about permanent change in an individual's knowledge, attitudes, or skills (Campbell, Dunnette, Lawler, & Weick, 1970). Goldstein (1992, as cited in Alawneh, 2008) provided a definition that related training to individual performance, which is arguably a more apt descriptor of HRD objectives. He defined training as the systematic acquisition of attitudes, concepts, knowledge, roles, or skills that result in improved performance at work. Generally, it has been found that most workplace training definitions in the international literature emphasize the current job as the focus. For instance, Tziner, Haccoun and Kadish (1991) noted that the fundamental purpose of training is to help people develop skills and abilities which, when applied at work, will enhance their average job performance in their current job. The definition provided by Tziner et al. links the acquisition of knowledge and skills gained through training to an application in the workplace. This link represents the concept of training transfer.

Transfer of Training: Terms and Concepts

Transfer of training is a core issue in order to link individual change to the requirements of the organizational system (Blickensderfer et al., 2005). Therefore, it is believed that training truly makes a difference in organizational and individual performance, it is necessary to understand how to support transfer of training in organizations.

Definition of Transfer of Training

Alahnew (2008) cited Broad (1997) and stated that training transfer is defined as “the application continued by learners to performance of jobs, individuals, community

responsibilities of knowledge in learning activities” (p. 2). In other words, transfer means that the learner is supposed to be able to apply the new training in a new situation. The focus of training employees is on the individual more than on the group; that is because of the nature of the final goal of training, which equips the individual with all or most of the skills mentioned above (Rothwell & Sredl, 2000, as cited in Alawneh).

Theories of Transfer Design

According to Holton (1996), one cause of failure to transfer is that, rarely does the training design itself provide for transfer of learning. That is, cognitive learning may well occur, but program participants may not have an opportunity to practice the training in a job context or may not be taught how to apply their knowledge on the job. So the training itself can have a direct influence on transfer of training. Holton’s evaluation model does not provide sufficient guidelines to explain what constitutes appropriate transfer designs. It is important to understand the theories that provide information about the conditions necessary to achieve positive transfer. The two primary viewpoints that describe the conditions necessary for transfer are the identical elements and the principles theories.

Identical Elements Theory

The theory of identical elements was proposed by Thorndike and Woodworth (1901, as cited in Yamnill & McLean, 2001). According to this theory, transfer is improved by an increase in the degree of correspondence among the training setting stimuli, responses, and conditions and those related factors operative in the performance setting. Holding (1965, as cited in Yamnill & McLean) summarized this work on transfer

and detailed the type of transfer expected based on the similarity of the stimuli and responses.

Principles Theory

In the principles theory, it is suggested that training should be focused on the general principles necessary to learn a task so that the learner can apply them to solve problems in the transfer environment (Goldstein, 1992, as cited in Alawneh, 2008). This theory suggests that it is possible to design training environments without too much concern about their similarity to the transfer situation, so long as it is possible to utilize the underlying principles.

Near and Far Transfer

According to Laker (1990, as cited in Yamnill & McLean, 2001), the transfer of training can be near or far. Near transfer is the application of learning to situations similar to those in which initial learning has taken place; far transfer is the application of learning to situations dissimilar to those of the original learning event. Whether one achieves near or far transfer appears to be dependent upon which theory of transfer guides the development and presentation of the training program.

Clark and Voogel (1985) suggested that the following recommendations would increase the likelihood of near transfer: (a) the more the training content and program reflect the workplace, the more successful the near transfer (Baldwin & Ford, 1988); (b) the greater the specificity about where and how the training is to be applied to the job, the more successful the near transfer (Clark & Voogel); (c) the more overlearning of the task is encouraged, the more successful the near transfer; (d) the more the procedural nature of the task is emphasized, the more successful the near transfer (Clark & Voogel); (e) the

more the application of the training is restricted only to those areas for which the learner was prepared, the more successful the near transfer (Clark & Voogel).

Theories of Transfer Climate

Transfer climate was described by Schneider and Rentsch (1997, as cited in Holton et al., 1997) as a “sense of imperative” (p. 97) that arises from a person’s perception of his or her work environment. It influences the extent to which that person can use learned skills on the job. Transfer climate is seen as a mediating variable in the relationship between the organizational context and an individual’s job attitudes and work behavior (Holton, Ruona, & Leimbach, 1998). When learning occurs in training, the transfer climate may either support or inhibit application of learning on the job. Organizational climate is at least as important as learning in facilitation of the transfer (Rouiller & Goldstein, 1993).

Transfer Climate Framework

Rouiller and Goldstein (1993) posited a conceptual framework for operational transfer climate; they suggested that transfer climate consists of two types of workplace cues (i.e., situation cues and consequence cues). Situation cues are to remind trainees of opportunities to use what they have learned when they return to work. There are four types of situation cues: (a) goal cues, (b) social cues, (c) task cues, and (d) self-control cues. Consequence cues are the feedback, which learners receive after they apply the knowledge, skills, and attitudes they gained in the training to their jobs. There are four types of consequences: (a) positive feedback, (b) negative feedback, (c) punishment, and (d) no feedback.

Organizational Theory

Organizational theory is used to describe organizational climate which supports the transfer of training in Holton's (1996) model. According to Kozlowski and Salas (1997, as cited in Yamnill & McLean, 2001), the need for change, the implementation of interventions, and the transfer of trained skills are embedded within the context of work team, subunit, and organization levels. They proposed an organizational theory that benefits from the application of concepts drawn from systems oriented theories.

Motivations and Barriers of Transfer

In the training setting, the organizational leaders are responsible for preparation of the climate of learning to the convenience of the learners (Merriam & Leahy, 2005). A number of strategies can be employed to enhance the learning transfer system. First, the organization has to ensure a supportive transfer climate and program planners may clarify with the supervisor what is to be learned and how that is transferred through follow-up assistance such as individual coaching and peer mentoring. Second, the organization should include learners in the planning. Third, the organization has to incorporate strategies that link to transfer in the program design (Merriam & Leahy).

Barriers to transfer could be caused by three factors: (a) barriers related to anticipation in the training program, (b) factors related to the organizational climate, and (c) training program design. First of all, the program designer should pay attention to the suitability of the program to fit their employees' interest, and a program that is related to their job. If the program failed to do so, the outcomes of learning will be weak and, as a result, there will be no learning transfer. All three sets of theories reviewed: (a)

motivation to transfer, (b) transfer design, and (c) transfer climate theories can help aviation professionals to better understand the factors that support transfer of training.

Chapter Summary

Scenario based training (SBT) is a current delivery system in aviation education and a member of the problem based learning (PBL) group of instructional methods. This method facilitates the enhancement of learning and the development and transference of thinking skills. For instructors, there are new roles and techniques to teach scenario based training in an operational environment that should be taken into consideration.

Based on the current research available about scenario based training and aviation education, instructors have many effective adult learning strategies and techniques to use in their operational training environment. These strategies and techniques are discussed more in Chapter 4. Some of these strategies and techniques are: (a) PBL (scenario based training) instruction and the learning process, such as training, learning, transfer, and performance outcome; (b) the teaching process, what is teaching, essential teaching skills, preparation of a lesson; and (c) the scenario based training process. In Chapter 3, Method, the author discusses the methodology involved in developing these effective strategies and techniques for the instruction of scenario based training.

Chapter 3

METHOD

Planning and methodology are behind every great project. This author describes the method used to develop a PowerPoint presentation for aviation instructors. The presentation includes strategies and techniques for aviation instructors to use in an operational training environment. Such training can include: (a) initial training, (b) transition training, (c) upgrade training, and (d) recurrent training. The purpose for designing this presentation is to help pilot instructors who have never taught a simulation (scenario) based training course develop their training skills. Also, experienced aviation instructors may find these strategies and techniques useful to expand their teaching skill set.

Target Audience

Trends in aviation training (i.e., the changes in pilot instruction proposed by the industry training standards represent changes in the content and delivery of pilot instruction) indicate a shift from traditional maneuver (part-task) based training approach to incorporate training that is scenario based, which requires different skills and competencies. The primary audience for this project is pilot instructors. To be more specific, this project is targeted towards pilot instructors in the aviation training industry.

Also, a list of effective instructional strategies and best practices could be beneficial to the following aviation professionals in aviation education: (a) training

managers, (b) program planners, (c) instructional designers, (d) simulator developers, and (e) business professionals such as trainers who facilitate pilot training programs.

Organization of the PowerPoint Presentation

The goal of this project is to help pilot instructors become effective instructors. It provides information in the areas of: (a) simulation and the learning process, such as training, learning, transfer, and performance outcome; (b) the teaching process, what is teaching, essential teaching skills, preparation of a lesson; and (c) teaching methods, such as the scenario based training model.

Peer Assessment Plan

The author asked four colleagues to review the PowerPoint slides and to provide informal feedback. Specifically, the reviewers were asked to consider the: (a) format or ease of understanding and use, (b) value or usefulness, and (c) recommendations for changes and improvements. This researcher met with each of the evaluators to discuss their recommendations. Their feedback is discussed in Chapter 5.

Chapter Summary

In this chapter, the author identified the target audience as aviation professionals in the aviation training industry. The author provided a detailed, step-by-step procedure for designing the presentation and a process for obtaining feedback from selected colleagues. Presented in Chapter 4 is the PowerPoint presentation of instructional strategies and best practices that pilot instructors can use to become more effective instructors.

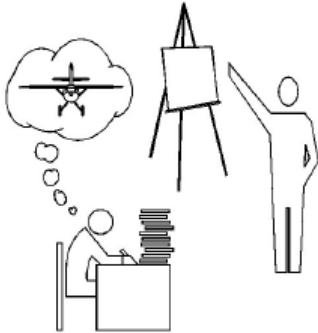
Chapter 4

RESULTS

Introduction

Currently, the aviation industry training standards emphasis has moved from a traditional based training standard to scenario based training (SBT). Aviation instructors have to assume a new role and function, based on a different set of industry training standards in an aviation training environment. The purpose of this project was to create a presentation, based on adult learning strategies, for pilot instructors to be able to effectively facilitate scenario based training. This presentation is designed for pilot instructors in the aviation industry. The strategies and techniques used in the presentation model are those which are identified as best practices in an aviation training environment.

Scenario Based Training In An Aviation Training Environment



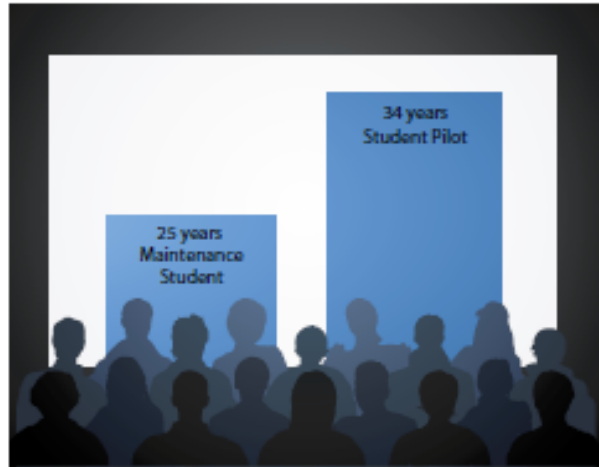


INTRODUCTION

Introduction

- In the past, the aviation instructor was a capable pilot with a rather general understanding of basic teaching methods and techniques.
- More recently, the aviation community has paid more attention to the instructor's role as teacher and mentor.
- Now, the instructor is required to master the teaching methods, write lesson objectives, outline and write lesson plans, and motivate students by example. The instructor is responsible for what is taught in the aircraft and classroom.
- The amount of learning that takes place is a direct result of how well the lesson is prepared and the teaching skill of the instructor.
- **Open Discussion**
 - Teaching the Adult Student (Learner)...
 - What does this mean?

Teaching the Adult Student



The average age of a student pilot is 34

Teaching the Adult Student

- Research shows that, as an individual matures, his or her mode of action moves from dependency to self-direction (FAA, 2008).
- Therefore, the age of the student impacts how the instructor designs the curriculum. Since the average age of a student can vary, the instructor needs to offer a curriculum that addresses the varying student tendency to self-direct.
- By observing human behavior, an instructor can gain the knowledge needed to better understand him or herself as an instructor as well as the learning needs of students. Understanding human behavior leads to successful instruction.



Teaching the Adult Student

Adults as learners possess the following characteristics...

Teaching the Adult Student...

- Adults who are motivated to seek out a learning experience do so primarily because they have a use for the knowledge or skill being sought. Learning is a means to an end, not an end in itself.
- Adults seek out learning experiences in order to cope with specific life-changing events—marriage, divorce, a new job. They are ready to learn when they assume new roles.
- Adults are autonomous and self-directed; they need to be independent and exercise control.
- Adults have accumulated a foundation of life experiences and knowledge and draw upon this reservoir of experience for learning.
- Adults are goal oriented.
- Adults are relevancy oriented. Their time perspective changes from one of postponed knowledge application to immediate application.
- Adults are practical, focusing on the aspects of a lesson most useful to them in their work.
- As do all learners, adults need to be shown respect.
- The need to increase or maintain a sense of self-esteem is a strong secondary motivator for adult learners.
- Adults want to solve problems and apply new knowledge immediately.



Teaching the Adult Student

Instructors should...

Instructors should...

- Provide a training syllabus that is organized with clearly defined course objectives to show the student how the training helps him or her attain specific goals.
- Help students integrate new ideas with what they already know to ensure they keep and use the new information.
- Take advantage of the adult preference to self-direct and self-design learning projects by giving the student frequent scenario based training (SBT) opportunities.
- Remember that self-direction does not mean isolation. Studies of self-directed learning indicate self-directed projects involve other people as resources, guides, etc.



What is Teaching?

Open Discussion

- What is teaching?



Teaching...

- ...to instruct or train someone, or the profession of someone who teaches.

Teaching

- Much research has been devoted to trying to discover what makes a “good” or effective instructor.
- This research has revealed that effective instructors come in many forms, but they generally possess four essential teaching skills: people skills, subject matter expertise, management skills, and assessment skills (FAA, 2008).

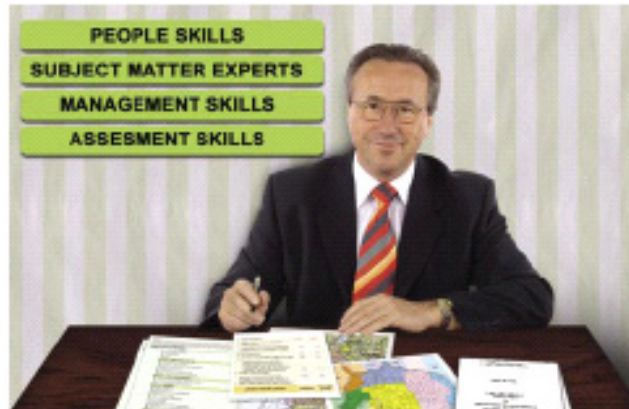


What are essential skills of an
effective instructor?

Open Discussion

- What are essential skills of an effective instructor?

Essential Skills



Essential Skills

- People skills are the ability to interact, talk, understand, empathize, and connect with people. Effective instructors relate well to people. Effective communication underlies people skills. It is important for instructors to remember: Technical knowledge is useless if the instructor fails to communicate it effectively. The two-way process of effective communication means actively listening to the student, as well as teaching him or her.
- A subject matter expert (SME) is a person who possesses a high level of expertise, knowledge, or skill in a particular area.
- Management skills generally include the ability to plan, organize, lead, and supervise. For the effective instructor, these skills are reflected in the ability to plan, organize, and carry out a lesson.
- Assessment of learning is a complex process and it is important to be clear about the purposes of the assessment. There are several points at which assessments can be made: before training, during training, and after training. Learning assessment is another important skill of an effective instructor.



The Learning Process

- Learning is the acquisition of knowledge or understanding of a subject or skill through education, experience, practice, or study. A change of behavior results from learning.
- To successfully bring about learning, the instructor must know why people act the way they do, how people learn, and then use this understanding to teach.
- We begin with a definition of learning and some of its characteristics.



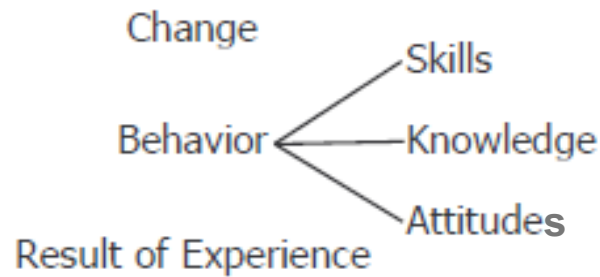
What is Learning?

Open Discussion

- What is learning?

Learning -

- A change in behavior as a result of experience.



Learning -

Learning can be defined in many ways:

- A change in the behavior of the learner as a result of experience. The behavior can be physical and overt, or it can be intellectual or attitudinal.
- The process by which experience brings about a relatively permanent change in behavior.
- The change in behavior that results from experience and practice.
- Gaining knowledge or skills (developing a behavior) through study, instruction, or experience.

Learning (cont.)



An effective instructor understands the characteristics of learning and assists students accordingly.

Learning (cont.)

- An effective instructor also realizes learning is a complex procedure and assists each student in reaching the learning outcomes while helping the student build self-esteem and confidence.
- The effective instructor understands the subject being taught, the student, the learning process, and the interrelationships that exist.



Characteristics of Learning

- Learning Is Purposeful
- Learning Comes Through Experience
- Learning Is Multifaceted
- Learning Is an Active Process

Characteristics of Learning

- To understand how people learn, it is necessary to understand what happens to the individual during the process.
- Knowledge of the general characteristics of learning help an aviation (pilot) instructor use them in a learning situation.
- If learning is a change in behavior as a result of experience, then instruction must include a careful and systematic creation of those experiences that promote learning.
- To be effective, the learning situation also should be purposeful, based on experience, multifaceted, and involve an active process.
 - Learning is purposeful. Students are unlikely to learn unless it is related to their goals.
 - It is a result of experience. The student learns from personal experience, but each student's response is conditioned by previous experiences.
 - It is multifaceted. The learning process may include verbal elements, conceptual elements, perceptual elements, emotional elements, and problem solving elements all taking place at once. While learning the subject at hand, students may be learning other things as well. This type of learning is sometimes referred to as incidental.
 - Learning is an active process. Students need to react and respond; not simply be present during instruction.



Learning Theory

- The Cognitive Theory
 - Constructivism
 - Higher Order Thinking Skill (HOTS)
 - Scenario Based Training

Learning Theory

- Learning theory is a body of principles advocated by psychologists and educators to explain how people acquire skills, knowledge, and attitudes.
- Cognitive theory focuses on what is going on inside the mind. It is more concerned with cognition (the process of thinking and learning)—knowing, perceiving, problem-solving, decision-making, awareness, and related intellectual activities—than with stimulus and response.
- A derivative of cognitive theory, constructivism is a philosophy of learning that can be traced to the eighteenth century. This theory holds that learners do not acquire knowledge and skills passively but actively build or construct them based on their experiences. Therefore, it creates a learner-centered learning environment in which learners assume responsibility for their own learning.
- In constructivist thinking, learners are given more latitude to become effective problem solvers, identifying and evaluating problems, as well as deciphering ways in which to transfer their learning to these problems, all of which foster critical thinking skills.
- While the student is at the center of the learning process, an experienced instructor (teacher) is necessary to guide them through the information jungle.



Higher Order Thinking Skills (HOTS)

- Teaching HOTS
 - Simple to complex thoughts
 - Concrete to abstract
- Teach based on
 - Problem based learning instruction
 - Authentic problems
 - Real world problems
 - Student-centered learning
 - Active learning
 - Cooperative learning
 - Customized instruction to meet the learner's needs

Higher Order Thinking Skills (HOTS)

- HOTS should be taught throughout the curriculum from simple to complex and from concrete to abstract.
- To teach the cognitive skills needed in making decisions and judgments effectively, an instructor should incorporate analysis, synthesis, and evaluation into lessons using problem-based learning (PBL).
- To teach HOTS effectively involves strategies and methods that include (1) using problem-based learning (PBL) instruction, (2) authentic problems, (3) real world problems, (4) student-centered learning, (5) active learning, (6) cooperative learning, and (7) customized instruction to meet the individual learner's needs.
- These strategies engage the learner in some form of mental activity, have the learner examine that mental activity and select the best solution, and challenge the learner to explore other ways to accomplish the task or the problem.



HOTS (cont.)

- Instructors must teach the cognitive skills used in problem solving until these techniques become automated and transferable to a new situation or problem.
- The learning of HOTS is not a change in observable behavior but the construction of meaning.

Higher Order Thinking Skills (HOTS)

- HOTS must be emphasized throughout a program of study for best results. For aviation, this means HOTS should be taught in the initial pilot training program and in every subsequent pilot training program.
- Instructors need to teach the cognitive skills used in problem solving until these techniques become automated and transferable to new situations or problems.
- Cognitive research has shown the learning of HOTS is not a change in observable behavior but the construction of meaning from experience.



THE TEACHING PROCESS

The Teaching Process

- The teaching process organizes the material an instructor wishes to teach in such a way that the learner understands what is being taught.
- The teaching process consists of four steps: preparation, presentation, application, and assessment.
- Regardless of the teaching or training delivery method used, the teaching process remains the same.
- To be effective, an instructor utilizes people skills, subject matter expertise, management skills, and assessment skills.



Steps of the Teaching Process

- **P**reparation
- **P**resentation
- **A**pplication
- **R**eview & Evaluation

Four Steps of the Teaching Process

- The teaching process consists of four steps: preparation, presentation, application, and review & evaluation.
- Regardless of the teaching or training delivery method used, the teaching process remains the same.



Preparation

- Determine what is to be covered, objective, and goals & evaluation criteria
- Study materials
- Determine equipment
- Write lesson plan

Preparation

- The first step of the teaching process, which consists of determining the scope of the lesson, the objectives, and the goals to be attained.



Presentation

- Problem Based Learning
 - Scenario Based Training (SBT) Method

Presentation

- The second step of the teaching process, which consists of delivering information or demonstrating the skills that make up the lesson.
- The instructor may choose from several methods of presentation.
 - Problem Based Learning
 - Scenario Based Training (SBT) Method



Application

- Student explains or perform new material
- May need to re-taught during this step if not correct

Application

- Application is where the student uses what the instructor has presented.
 - As the student becomes proficient with the fundamentals of flight and aircraft maneuvers, the instructor should increasingly emphasize ADM as a means of applying what has been previously learned.



Review and Evaluation

- Review to emphasize important elements
- Evaluate to determine if goals (objective have been met)

Review and Evaluation

- The fourth and last step in the teaching process, which consists of a review of all material and an evaluation of the students. In the telling and doing technique of flight instruction, this step consists of the instructor evaluating the student's performance while the student performs the required procedure.
- An integral part of each classroom and/or flight lesson.
 - Review to emphasize important elements
 - Evaluation of student performance and accomplishment during a lesson should be based on the objectives and goals that were established in the instructor's lesson plan.



Teaching Methods

Teaching Methods

- Some instructors rely on lectures, others demonstrate, and others may prefer scenario based training.
- Everyone has a mixture of strengths and preferences, not a single style or preference to the complete exclusion of any other.
- Please bear this in mind when using these ideas.



Problem Based Learning

Training Delivery Methods

Problem Based Learning

- In 1966, the McMaster University School of Medicine in Canada pioneered a new approach to teaching and curriculum design called problem based learning [PBL] (FAA, 2008).
- PBL has helped shift the focus of learning from an instructor-centered approach to a learner-centered approach.
- Definitions for PBL, but for the purposes of this project, it is defined as the type of learning environment in which lessons are structured in such a way as to confront students with problems encountered in real life that force them to reach real world solutions (FAA, 2008).



Problem Based Learning (cont.)

- Relate to real world
- Require students to make decisions
- Situations are ended and do not have only one correct answer
- Build on previously learned knowledge
- Reflect lesson objectives
- Challenge students to think critically

Problem Based Learning (cont.)

- PBL starts with a carefully constructed problem to which there is no single solution.
- The benefit of PBL lies in helping the learner gain a deeper understanding of the information and in the learner improving his or her ability to recall the information.
- This results when the material is presented as an authentic problem in a situated environment that allows the learner to “make meaning” of the information based on his or her past experience and personal interpretation.
- This type of problem encourages the development of HOTS, which include cognitive processes such as problem solving and decision-making, as well as the cognitive skills of analysis, synthesis and evaluation.



Scenario Based Training (SBT)

Scenario Based Training (SBT)

- Currently, a new aviation industry training standard emphasis has moved from a maneuvers based training standard to what is called scenario based training (SBT).
- SBT as it is used here is likely different than what you are use to; that is, SBT is a teaching method that provides enhanced learning opportunities rather than the setting given during an emergency.
- In the training approach to pilot training, scenario-based training is a teaching method that embeds tasks in meaningful scenarios to improve learning. Maneuvers are not taught as stand-alone items but can be used within a scenario to develop the needed skills.
- We will talk about this in this module.



What Is SBT?

Open Discussion

- What is SBT?



Scenario Based Training (SBT)

- SBT is a training system (teaching and learning method) that uses a highly structured script of real-world experiences to address flight-evaluation in an operational environment.

Scenario Based Training (SBT)

- What does this mean? SBT is not simply a set of circumstances surrounding an emergency or some other problem presented during training. In most cases, this is how scenarios have been used to date.
- “SBT is a training system (teaching and learning method) ...” means that SBT is a number of steps designed to promote learning and to engage the learner in the learning process. Initially the pilot (learner) may be given a problem to solve, yet the problem is the only the first step in this learning method.
- “... uses a highly structured script ...” means that we need to focus on the desired activity. We need to follow a logical sequence in our building block approach toward our desired outcome. Like other teaching method we need to work from the known to the unknown, from simple to complex, and from concrete to abstract.



SBT (cont.)

- SBT is a training system (teaching and learning method) that uses a highly structured script of real-world experiences to address flight-evaluation in an operational environment.

SBT (cont.)

- “... real-world experiences ...” means that we need to use scenarios that are realistic and authentic. That is, we need to set up situations that the pilot may actually encounter or believes he or she could encounter.
- “... address flight evaluation in an operational environment.” means to set up situations that will cause the pilot to make decisions and take some action. Often we will need to draw the learner into the decision process rather than allowing him or her to sit back and watch us solve the problem. SBT is a multi-step learning process that uses realistic and authentic problems to promote learning and to engage the learner (pilot). Scenario is a single mission that meets the learning objective(s) of that flight.
- More on this will be discussed later.



SBT (cont.)

- SBT is the heart of HOTS
- The learner is required to
 - Formulate possible solutions
 - Evaluate those solutions
 - Decide on a solution
 - Judge the appropriateness of the solution
 - Reflect on the process used

SBT (cont.)

- At the heart of HOTS lies scenario based training (SBT) which is an example of the PBL instructional method and facilitates the enhancement of learning and the development and transference of thinking skill.
- Discussing the solution and other possible solutions will lead to broader understanding where a single in-flight event can be expanded to a many situations and possible solutions. And opportunities to practice and rehearse judgment and decision-making.



Scenario vs. Maneuver-Based Training

- Maneuver-based training teaches students task.
- Scenario-based training teaches students to solve problem and complete tasks encountered before, during, and after the flight.

Scenario vs. Maneuver-Based Training

- Maneuver-based training uses well established building block maneuvers to develop the necessary skills.
- In its simplest form, SBT strings these maneuvers into a flight that has a reason to be flown. Often the student does not know or understand how the skills learned and/or practiced within a maneuver are used or needed in a typical flight (non-training).
- SBT should provide the “big picture” rather than the series of individual and often unrelated tasks that the maneuver-based training approach uses.
- NOTE: There will be times when maneuvers training will be necessary. For example, crosswind takeoffs and landings for development of psychomotor skills.



Is there more to scenario?

- For a basic scenario – no
 - In the example, the student is given a maneuver and a reason for doing it
- For scenario-based training – yes
 - Additional steps are needed

Is there more to scenario?

- In the scenario-base training approach, we want the learner to develop thinking skills while acquiring aeronautical knowledge.
- This approach provides opportunities for developing thinking skills (judgment and decision-making) and opportunities to broaden knowledge through guided discussions.



Scenario Development

- Scenarios are used in instruction and in evaluation
- For SBT to be effective, it must have a purpose and consequences

Scenario Development

- However, SBT must have a purpose and consequences.
- Providing a purpose for a flight to be flown and establishing consequences for not completing the flight helps engage the student into the lesson.
- That is, students tend to attempt to solve problems that will result in getting to the planned destination rather than aborting the flight at the first indication of malfunction or problem. This produces a better learning experience.
- Next we will discuss the SBT method.



Five steps in developing SBT

- Determine the objectives and goals (desired outcomes)
- Determine the content including: theories, concepts, and issues
- Develop the learning activities (problems)
- Develop assessments
- Adjust the objectives, desired outcomes, content, learning activities, and assessment as necessary to achieve goals

Five steps in developing SBT

- The steps in developing SBT are the same as the steps in developing any other training with the exception that we will use problems as the centerpiece of the learning activities.
- The challenge then becomes what problem clearly covers each of the theories, concepts, and issues involved in the topic.
- In most cases, there will not be a single problem but rather a series of problems needed for each theory, concept, and issue.
- We will still need to break the material down into manageable pieces and use a building block approach. We will simply be expressing the material in a problem format rather than a block of information.



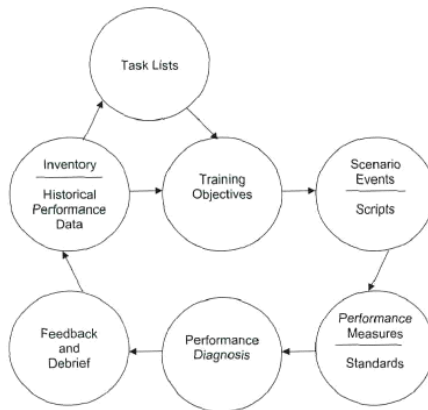
How are training and evaluation scenarios different?

- The evaluation scenario provides
 - the evaluation opportunities to observe the student make judgments and decisions
 - rather than learning opportunities for the student

How are training and evaluation scenarios different?

- The training scenarios provide opportunities to practice judgment and aeronautical decision-making while the evaluation scenarios provide opportunities to evaluate the choices the applicant made.
- During a training scenario the instructor may provide coaching and assistance or observe for later discussions. During evaluation scenarios the examiner will not coach and assist, and will only intervene when the outcome is seriously in doubt.

Scenario Based Training Process



Scenario based training model, adapted from Oser et al., 1999

Scenario Based Training Process

- Oser et al. (1999) presented a framework defining the components of scenario-based training. As the figure indicates, scenario based training links various aspect of training development and delivery.
- This approach guides training designers and/or instructors to:
 - identify the task/mission and the knowledge, skills, and abilities involved;
 - design scenarios to include events which allow the learner to develop and practice the specific knowledge, skills, and abilities identified;
 - design performance measures to enable the instructor to assess performance; and
 - ensure that specific feedback is given to the learner.
- The purpose of the Oser et al. (1999) model is to help training developers and instructors organize their approach to design and implement SBT. Also, it can help to guide the process which defines a set of features or attributes that must be present in order to ensure that the training is effective.

Questions or Comments?



Open Discussion or Comments

- Questions or Comments?

Chapter Summary

The effective strategies and techniques produced during this research project are meant to be a starting point for instructors to assist them in transitioning from the traditional (maneuver based) training environment to a simulated (scenario based) training environment. The list of effective strategies and techniques is meant to serve as a supplemental resource tool to aid aviation (pilot) instructors within pilot training programs. In addition to print guidance materials, there are several other ways for instructors new to scenario based learning, educational psychology, teaching methods, testing, and other aviation related subjects to gain knowledge and support, such as Federal Aviation Administration (FAA) seminars, industry conventions, professional organizations, and online classes. Networking with and observing other instructors to learn new strategies are also helpful (FAA, 2008). In Chapters 5, this author discusses the completed project.

Chapter 5

DISCUSSION

The main issue addressed by this research project is the fact that scenario (simulation) based learning presents a new teaching environment and new instructor responsibilities. The purpose of this project was to develop a presentation of effective strategies and techniques for teaching scenario based courses for those new to the simulated operational environment. These effective strategies would be most beneficial to those with limited time to gather and synthesize the research data for SBT.

Contribution of the Project

The objective of this project was satisfied in that the author produced a tool that can be utilized and/or customized to most pilot training programs. Also, it can serve as a useful resource for new pilot instructors who are engaged in an introductory scenario based training program. The most beneficial factor related to this set of strategies and techniques is its flexibility; the set of strategies and techniques produced in this project provides a framework whereby instructors/designers can modify the strategies to coincide with their specific situational needs. This also means that scenario content can be reused with different technologies or media.

Limitations

A limitation of this research project is the absence of practice time. To become successful (more effective) instructors, the instructors need to incorporate and practice the instructional strategies and techniques. This project presents best practices and

effective strategies and techniques they should use in their training programs, but it does not allow time for the instructors to practice these strategies.

Peer Assessment Results

The author asked four colleagues to review the presentation and to provide informal feedback. After viewing the presentation, each evaluator was asked a series of questions that were intended to provide structured feedback. When evaluators were asked how well this project met the original objective, each indicated that the project did provide a comprehensive set of useful strategies and techniques for pilot instructors. One evaluator described how she could see the presentation being used with the leadership team to support professional development initiatives for designers and instructors. All evaluators indicated that the presentation was engaging and that the format was easy to follow and understand.

Recommendations for Further Development

One recommendation for further development would be to observe and evaluate instructors teaching in a simulated environment after receiving this presentation. During this evaluation, the following questions should be addressed: Did the instructors apply the strategies and techniques presented to them? Which strategies and techniques did the instructor/designer incorporate? How did the learners respond to this change? Once the data from this assessment has been evaluated, additional support could be provided to the instructor if needed. Additionally, one-on-one mentoring could be scheduled to help instructors develop their skills further. Also, the author could convert the set of effective strategies and techniques into a handbook that could be used as a supplement to the professional instructor course (PIC).

Project Summary

Advances in aviation technology and innovations in learning technology provide aviation instructors with the opportunity to use new methods and teach to new standards, which requires different skills and competencies. One of these methods is scenario based training (SBT). “While SBT is an integral component of today’s aviation training, the instructor is crucial to its implementation” (FAA, 2008, p. 6-2). The purpose of this project was to help address this issue by developing effective strategies and techniques for instruction using scenario based training that instructors can effectively utilize when teaching in a scenario based training environment. The goal of this research project was effectively met by creating a presentation of effective strategies and techniques to meet the training needs of aviation instructors new to the operational training environment.

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