UNITED AIRLINES USE OF CRI/CMI/CAI

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ABSTRACT

Since January, 1978, United Airlines has been using the PLATO computerized system to manage an individualized, criterion referenced instructional (CRI) program for newly hired pilots. This program was designed utilizing the CRI concept to take advantage of trainees' existing knowledge repertoires, the different rates at which trainees learn, and for scheduling flexibility. Criterion tests, used to measure expected performance, are presented on the PLATO Computer Managed Instruction (CMI) system; learning resources are printed materials, slide-tapes and video-tapes. The next program that was developed and implemented in January, 1980, Initial First Officer, utilizes both the CMI and Computer Assisted Instruction (CAI) features of PLATO. Also based on CRI design, this program is presented on PLATO as CAI lessons yet still contains the advantages of CMI record keeping. In addition, no external media is necessary, the trainee is provided immediate feedback, and appropriate learning material is given on the spot.

BACKGROUND

The United Airlines Flight Operations Training Center, located in Denver, Colorado, is a central facility responsible for all training of United's 5,500 pilots. The largest activity is Transition training which qualifies pilots when they move from one airplane to another. In addition, semi-annual Proficiency checks, Recurrent training, Requalification training, Emergency Procedures training, New Hire training, Initial Captain and Initial First Officer training is conducted continuously.

INTRODUCTION TO THE NEW HIRE COURSE

In 1976, the Flight Training Program Development group at United was given the responsibility to develop a training program for newly hired pilots (Second Officers). Specifically it was essential that the training would assure that any newly hired pilot would be able to enter any of the regular transition training programs prepared to meet the objectives of those programs with no modifications to the existing transition training. This meant that new pilots had to be brought up to the entry level of knowledge on which the transition training programs are based. To compound this problem, the expectations of the availability of pilot candidates and the qualification standards for selection led us to expect a wide range of student experience in each class. We could expect students with experience ranging from light airplane time to those with extensive multi-engine jet experience from the military. It had been eight years since United had hired new pilots, and they had been trained with a conventional, instructor-led classroom course. The factors facing us now, however, pointed out the inefficiency of a traditional, lock-step program which assumes that all trainees require the same training. A program which requires the experienced pilot to sit in a classroom receiving the same lectures as the minimally qualified pilot is not only wasteful and inefficient, but boring as well.

NEW HIRE COURSE DESIGN

Based on an analysis of the situation, then, it was determined that utilizing the principles of Criterion Referenced Instruction (CRI) would best meet the need. This meant that the program would be results oriented and tailored to meet individual needs. Criterion tests would be used to measure expected performance with mastery of all the tests necessary to complete the course.

The acceptance of CRI principles allows the content of the training to be as much or as little as a particular trainee needs to help master the criterion tests. The number of hours a trainee might spend in training, or the amount of information he or she is exposed to, should have no effect on trainee accountability. The potential impact on trainee time becomes readily apparent.

Use of a CBT System

With CRI as the underlying instructional philosophy for the New Hire Program, the use of a Computer Based Training (CBT) system for administration of the program was considered. After much investigation, United management determined that a CBT system was essential due to the complexity of the training task and the necessity for a very high degree of control over our target population-qualified flight crew members. Errors in record keeping of performance on criterion tests cannot be tolerated in our environment. All parties (Company, Federal Aviation Administration (FAA), Instructors and Flight Crew members) must be assured of complete satisfactory performance on all criterion tests.

The CBT systems available were evaluated and Control Data Corporation's PLATO system was selected because its management system was ideally set up to conduct our application for newly hired pilots. PLATO's Computerized Managed Instruction (CMI) system administers the criterion tests, prescribes training materials and monitors trainee progress. The CMI system is pre-programmed, and as a result, input can be accomplished largely by clerical personnel. In addition, set up of the course and all other necessary input can be handled by development personnel, thus eliminating the need for computer programmers.

NEW HIRE COURSE DESCRIPTION

United's New Hire Training consists of 28 modules, each of which is further broken down into Objectives or Instructional Units (IUs). Each IU has identified with it one or more Learning Resources (LRs). The content consists of Orientation, Advanced Aeronautical and Job Related subjects.

New Hire Criterion Testing

The criterion testing is accomplished on the Module level but LRs are prescribed on the IU level. For example, if a Module contains 4 IUs, a test is administered for each IU, but mastery/non-mastery scoring takes place on the Module level; that is, a student is tested on a Module basis and cannot choose an individual IU test. The PLATO system keeps track of test mastery and when the Module is completed, indicates to the trainee which, if any, of the IU tests have been mastered. For the unmastered IUs, PLATO prescribes LRs which will help the trainee learn the content in preparation for his/her next attempt at a test. The next time a trainee takes a test, only the unmastered IU tests are presented. In this example, if three of the four IU tests are mastered on the first attempt, the trainee will be tested only on the one unmastered IU on the next attempt. The next test covers the same objective but consists of a different set of questions. If a trainee fails this test, he/she is locked out of further testing, and is either given an alternate LR, or discusses the content with a subject matter expert. Criterion for test mastery varies within Modules, but the range is 80% to 90%.

New Hire Learning Resources

Learning Resources for the Course consist of slide-tapes, video-tapes, emergency equipment and written materials. Most of these were developed specifically for this course, but some of them were chosen from existing materials. Individual study carrels in a Learning Center are available for the individualized instruction.

New Hire Course Options

When going through this course, the trainee has the option of taking the test first or studying the LRs first. Since the trainee receives the course objectives prior to start-up, he/she can determine his/her course of action based on individual knowledge repertoire. For those tests that are mastered first, the trainee is not required to take any LRs, but, of course, is not prohibited from using them. In this manner, training is tailored to individual needs, and training time is not wasted in areas where proficiency is demonstrated.

RESULTS OF NEW HIRE COURSE

This New Hire Course was conducted from January, 1978 to October, 1979. (The Course has been suspended due to a lack of need for new Second Officers). 835 trainees completed the training in an average time of 9.5 elapsed days with a range from 4 to 15 days. The conventional stand-up course that was replaced by this CRI course took 26 elapsed days. In addition, three instructors who were assigned for subject matter expertise were rarely consulted and were replaced by personnel for coordination at significantly lower salaries.

Benefits and Advantages

The benefits and advantages of the New Hire Course were significant:

* Reduced training time allowed trainees to move into a transition program earlier, thereby sending well qualified pilots into line operation much sooner.

* Reduced instructor staff eliminated the need to replace the instructor's original positions. All instructors returned to the jobs they had before becoming members of the New Hire staff.

* Instruction is consistent. All trainees receive (if needed) the same instruction and all tests are completed to mastery. This eliminated the conventional, subjective judgments made by instructors. Trainees preferred the new course since they were responsible for identical material and were judged consistently.

* PLATO CMI kept all trainee records current. A trainee knew exactly where he/she was at all times and could plan appropriately. Management was able to see exactly where trainees were at a given moment and could use this data to provide even more individual help if needed.
Trainees were more relaxed and enjoyed the individual interaction with other trainees that occurs spontaneously with an individualized program.

* Changing of poorly worded or unclear questions, misspellings, and all other necessary editing corrections was accomplished on the spot in PLATO. This eliminated the problem of making pencil changes to what would have amounted to multiple hard copies.

* Obviously, money was saved. Exactly how much was not specifically determined due to complex accounting. Trainees became line crew members more quickly than anticipated, and as a result, more flights were flown, more passengers boarded, etc. However, it was conservatively estimated that, after paying for the use of PLATO, well over $100,000 a year would be saved just due to instructor salaries and less trainee time spent in training instead of being productive line pilots.

Disadvantages

Two major disadvantages existed with the New Hire Course that are worth noting:

* Due to a managerial decision concerning security of the criterion tests, trainees received no feedback to the questions. They did not know which questions were answered correctly or incorrectly. This placed them in more of a straight testing mode rather than in a combination testing/learning process which we consider more desirable. Many students felt this lack of feedback was inappropriate and, at times, caused some minor frustrations.

* We did not use Computer Assisted Instruction (CAI) in this Course. This was due to the lack of programming personnel available who could work with the PLATO language. This more dynamic feature, CAI, of a CBT system could have provided trainee - PLATO interaction which would have been more meaningful to the trainee in the learning process.

FAA Acceptance

The advantages of the New Hire Course, however, strongly outweighed the disadvantages, and the course was widely accepted throughout the company and with the FAA. The FAA regulates all of our courses and approves general content and number of hours required for a given course. Since we could not provide a specific number of hours for New Hire Course completion due to the CRI and individualized concept, FAA approval of the design was a major change in their regulations. This was considered to be a significant breakthrough in the agency's somewhat traditional approach to training, and it paved the way for us to continue in our pursuit of applying the CRI/CMI approach to other courses at the Training Center.

INTRODUCTION TO IFO

The next course to be redeveloped was the Initial First Officer (IFO) Course which is designed to upgrade Second Officers into First Officers positions. Course content consists of a review of Meteorology, Radar, and United's Flight Operations Manual (FOM), and contains 15 modules broken down into a number of IUs. It is similar to the New Hire Course in that the principles of CRI were used for design and development, and PLATO CMI is used for test administration, LR prescription and record keeping. There are significant differences, however, between the two courses in the areas of criterion, learning resources and feedback.

IFO COURSE DESCRIPTION

Here's how the IFO Course works:

As in New Hire, the trainee has the option of taking any, or all, of the LRs first, or, if after reading the objectives, of taking the test first. In the IFO Course, however, all of the LRs are CAI lessons instead of the multi-media LRs of the New Hire Course. The use of CAI allowed the Program Development staff to utilize the interaction feature of PLATO to improve instruction. It's also much more efficient for the trainee to have everything right in front of him in one carrel using one piece of equipment. The content of the Course was such that PLATO graphics and a supplemental book of drawings and pictures could easily replace the more expensive use of slide-tapes and video-tapes.

IFO Criterion Tests

The criterion tests in the IFO Course have two sets of questions, an "A" set and a "B" set. Typically, the trainee will be presented the "A" question first, let's say "1A. If he/she gets it correct, it will be so noted, and he/she will continue on to "2A." If he/she gets it wrong, it will be so noted, and the trainee will receive Feedback (FB) explaining content related to the missed question. After the FB, the next "A" question is presented. This procedure continues until the end of the test. After all of the "A" questions are presented, the trainee receives the "B" questions that directly relate to the missed question(s). If any "B" question is missed, the test is unmastered and the trainee is automatically locked out of further testing in that Module, and must take the appropriate LR(s) before being retested. This cycle continues, then, until mastery is achieved; that is, until no "A" or "B" questions are missed.

RESULTS OF IFO COURSE

The CRI/IFO Course was conducted from January, 1980 to May, 1980. (Classes have been suspended for a short time due to lack of need for new First Officers). 38 trainees completed the training in an average time of 4.5 elapsed days with the range from 3 to 7 days. The conventional, stand-up course that was replaced by this CRI course took 10 elapsed days. In addition, two instructor positions were eliminated; coordination of the course is provided by the same personnel who administer the New Hire Course.

COMPARISON OF NEW HIRE AND IFO

Because of the CRI design and the individualization of the IFO Course, the benefits and advantages attained were similar to those accomplished with the New Hire Course. The disadvantages cited in the discussion of New Hire, however, were eliminated in the IFO Course.

Difference in Feedback

In New Hire, no feedback to the questions was provided; in IFO, not only were the trainees given correct/incorrect answer information, they were also given immediate instruction relating to the subject matter of the question missed. As a result, trainees knew immediately how well they were doing and learned why they answered a question incorrecty. Their learning was then reinforced when they had to answer a similar question to the one missed within a reasonably short period of time. Thus, trainees in the IFO Course were placed in a testing/learning environment as opposed to a strictly testing situation (as in New Hire), and the Course was more meaningful to them. They were also more at ease because they knew how they were progressing with each question and didn't feel the pressure of not knowing how they were doing until the test was completed, as was the case with New Hire.

Differences in Learning Resources

Another major difference between the two courses was the Learning Resources. While some of the slide-tapes were appropriate for the subject matter in New Hire, many of them were unnecessary, but were done that way simply because that's the way we had done them for many years. Slide-tapes were accepted and were considered the appropriate medium for most learning situations. While designing and developing the IFO Course, we determined that PLATO graphics available through CAI were as appropriate, if not more so, for most of the content than were slide-tapes. Trainees felt that the interaction with PLATO was extremely valuable and meaningful, and they were less bored as a result. Also, editing was handled quickly and efficiently, trainees did not have to cope with potential hardware problems and the lessons were easily accessible and readily available.

Difference in Criteria

Finally, the criterion established for each course was different. In New Hire, the criterion for module mastery ranged from 80% to 90% while in IFO, the criterion was effectively 100%. In New Hire, when a trainee reached the necessary criterion while taking a test, the test was stopped and the trainee did not see the remaining questions. In IFO, the trainee saw all of the questions and had to answer correctly all of the questions or alternates in order to master a module. In this case, we were assured that the trainees were exposed to all of the needed information, and they attained mastery only after responding correctly to 100% of the questions.

CONCLUSIONS

Both courses, despite the differences, accomplished their objectives. Trainees who completed training continued on to the next phases with the knowledge necessary to successfully become new Second and First Officers. Further, both courses were objective appraisals of trainee knowledge. Prior to these courses, mere completion of a course was adequate criterion for success. With the new courses, trainees, under more pressure, were somewhat apprehensive at first, but most of them appreciated the logic behind the rationale for objectivity. As with most professionals, when given an opportunity to "prove" themselves, our trainees overcame any misgivings they had, and completed the courses with minimal difficulty.

FUTURE APPLICATIONS

Due largely to the success of these two courses, United has committed itself to the use of PLATO in the future. Two more applications are underway - the Initial Captain Course and the DC-10 Flight Guidance System are being developed using CRI/CMI/CAI.

In addition, PLATO's largest contribution will be with our new airplane program - the Boeing 767. Not only will PLATO be used in a similar manner as described in this paper, but it will also be used in the simulator as an interface with the simulator computer, and will store all trainee records throughout the entire training program. The 767 program will be on-line in early 1982 and it is anticipated that the program design, development, and implementation, using PLATO as an integral part will be the most modern airplane training program in existence. The use of the CRI/CMI/CAI concept will account for the entire program and should prove to be the most meaningful, successful program ever developed in the airline industry.

ABOUT THE AUTHOR

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