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QUALITY TRAINING AND LEARNING IN
AVIATION: PROBLEMS OF ALIGNMENT

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ABSTRACT

The challenge of producing training programs that lead to quality learning outcomes is ever present in aviation, especially when economic and regulatory pressures are brought into the equation. Previous research by Telfer & Moore (1997) indicates the importance of appropriate alignment of beliefs about learning across all levels of an organization from the managerial level, through the instructor/check and training level, to the pilots and other crew. This paper argues for a central focus on approaches to learning and training that encourage understanding, problem solving and application. Recent research in the area is emphasized as are methods and techniques for enhancing deeper learning.

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INTRODUCTION

The bean counters will never give us the money to train properly....

How can we provide check and training if we aren't given the funds we need?

Management will not approve the extra hours we need for training....

Why doesn't our management realize that to train properly we need appropriate funding?

Training is the key to an efficient airline: why won't the accountants recognize this?

Sound familiar? The tension between training departments and budgetary control in aviation management is a perennial issue. Reduced to its elements, the conflict is one of quality versus quantity, or effectiveness versus efficiency. A solution argued in this paper is that present approaches to training contribute to the tension and are part of the problem. The common solution to a training problem is to provide more training; unfortunately, it is usually more of the same. The ab initio pilot who flies more and more circuits in order to gain expertise in flaring the aircraft in landing will eventually make it: but at what cost?

The cost extends way beyond the dollars. Think of the soul-destroying repetition for the instructor, the reputation of the training establishment, the self-concept of the trainee, the changing attitude towards further training, and the loss of motivation. The overall cost is massive. Now let us extend this cost structure into an airline, and consider it over an extended period. Training is more than big bucks: it is big costs.

One way of reducing the training costs is to work on the quality of training: which means improving the quality of a trainee's learning. Our recent research, part of an ongoing international study by Moore, Telfer and Smith (1994), Telfer and Moore (1997) and Lehrer, Moore and Telfer (1998), provides insight into how this can be achieved.

BACKGROUND

Our research is concerned with the motives and strategies that learners, instructors, and managers have for learning. As Telfer (1994) notes, the outcomes of training are very much determined by the motivation and strategies of the individual pilot or student, by the instructor or check and training captain's values, skills and knowledge (especially about learning and instruction), and by the nature of the organization or system in which the training occurs. Central to our work are questions such as: Is learning just remembering and being able to repeat the information without understanding? Is learning a sense of challenge? Is learning something that increases anxiety? Is learning about doing well? What do instructors know about learning? Do they see learning in a manner similar to that of their trainees? What do training managers think of learning and instruction?

Before moving to examine these questions in more detail, there is merit in placing the instructional cycle into a context and Biggs and Moore's (1993) 3P Model of Learning provides a useful framework. Their 3Ps refer to Presage, Process and Product factors as they relate to learning. Presage factors are the baggage that pilots, students, instructors and the organization bring to learning. For pilots and students these include age, experience, abilities, personality, and their preferred way of learning. For instructors, their Presage factors include age, experiences, motivations, personalities and their beliefs and views about learning. Organization factors such as the training syllabus, provision of resources and facilities, scheduling, supervision, and the effects of regulatory authorities are part of Presage as well. (We will return to these organizational factors in the concluding section of the paper.)

The second P in the 3P model is Process, the actual processes that occur when a pilot or trainee, and instructor, engage in a particular task or set of tasks. Clearly, the above Presage factors influence how that occurs. The pilot's baggage for learning interacts with that of the instructor and the organization.

The final P is Product, the outcomes of learning. Can the trainee now do what is expected? Can they pass the test? What type of test is it? Typically, outcomes are measured quantitatively (She got 78 percent or he rated at 4/5) and presumably the higher the rating or score the more has been learned or the better the overall performance. Qualitative assessment also is used when judgements are made about the quality of the learning outcome (This response shows a good level of integration and understanding with application to novel problems.) However, it is well recognized that the Product component of the model has the potential to wag both Presage and Process parts of the model. If, for example, the tests are of low level details and facts, then it is likely that after repeated experiences of such tests both trainees and instructors will focus their learning on such details, perhaps to the detriment of understanding and application. So, the 3P Model represents a convenient way of examining learning and instruction, from the perspective of what is brought to the learning situation, what occurs in the learning, and what is assessed. It may be stating the obvious, but if each of these is out of synchrony, then potential problems will arise. Now, to return to the questions posed at the beginning of this section.

For aviation the posing of such questions, and their answers, are important for a number of reasons. Firstly, there is a substantial body of literature that demonstrates the effects of learner approaches to learning on subsequent learning outcomes (Biggs, 1999, 1987; Biggs & Moore, 1993). Individuals who are Surface in orientation (Biggs, 1999, 1987) are primarily motivated to do the least amount of work possible to get through a

course, are sometimes anxious about their learning (and possible failure), and rely extensively upon rote learning or learning things by-heart (without understanding) to pass a test or training program. Individuals who are Deep in orientation are quite different to those who are Surface, because they tend to see learning as a challenge, as something which gives enjoyment through mastering what has to be learned and they employ a range of strategies that ensure that understanding emerges (e.g., taking own notes, summarizing, discussing with others). Biggs (1987) identifies a third approach to learning, the Achieving approach. This approach is characterized by a desire to do well, compete and be organized for learning. Of course, there may be circumstances in which each of these approaches is appropriate but for the most part, understanding should be a priority. (It is very difficult to argue against understanding in aviation when you think of the ways in which the crew handled the well-documented Sioux City accident.)

From typical school, college, and university studies, there is evidence that Surface approaches to learning tend to be harmful and that Deep and Achieving approaches are more beneficial to learning (e.g., Biggs, 1987; Cantwell & Moore, 1998; Drew & Watkins, 1998). Moore and Telfer (1990) replicated these findings in ab initio aviation settings. Indeed, they showed that those who were deeper in their approaches to learning, went solo earlier than those trainees who were not so oriented. Work with experienced pilots by Moore, Telfer and Smith (1994) and Monfries and Moore (1998) illustrates a general propensity of Deep and Achieving in captains and first officers, with Deep scores being higher. Surface approaches to learning were ranked low by experienced pilots but there were differences between pilots from different airlines suggesting both corporate and national cultural effects.

Secondly, there is evidence that students and pilots are influenced by the beliefs of those who instruct them. In school settings, for example, Tang (1993) demonstrated that teacher knowledge influenced students' approaches to learning (they were Deeper with experts) and Richardson, Andes, Tidwell and Lloyd (1991) showed a positive link between teachers' classroom practices and their beliefs about learning. In aviation, Henley's (1995) work amply shows that beliefs about learning influence how instruction is conducted, how feedback is provided, how expectations are established and so on. Her findings are important because, as Biggs (1999) indicates, student approaches to learning are essentially reactions to the teaching/instructional environment.

Thirdly, there is evidence that organizational factors influence learning. It is not difficult to think of examples where the organization makes (or breaks) quality learning. At the simplest level, the allocation of appropriate

resources (say a high fidelity simulator) can influence the quality and effectiveness of learning, as can the time devoted to training. Similarly, there needs to be a corporate sense of commitment to high quality training, compared to just minimally meeting the regulatory requirements (Maurino, 1997). Bent and Fry (1997) reinforce the critical role of appropriate resource investment by the organization when new aircraft are introduced into the fleet.

Fourthly, there is potential problem of lack of congruence or poor alignment across the three levels of student/pilot, instructor, and organization. What if the expectations of the instructors are different from those of the organization? What if the objectives are on understanding but testing is on unrelated facts? What if the pilots are motivated to understand but their instructors focus on surface level matters? Conflicts of perceptions and expectations in learning are not conducive to quality learning (Cohen, 1987). The next section of this paper examines one of these issues specifically, a comparison between pilots and instructors' views on learning, their approaches to learning and instruction.

PILOT AND INSTRUCTOR APPROACHES

We were concerned about the possibilities of different perspectives on learning being taken by pilots and instructors. Do they align or not was the basic question, and a subsidiary question was if they were, were they appropriate in terms of quality learning. We used the constructs of Deep, Surface and Achieving developed by Biggs (1987) and in order to make some comparisons between pilot and instructor beliefs about learning, we compared pilot data previously reported by us (Moore, Telfer & Smith, 1994; Moore, 1995) with some data we gathered from instructors more recently (For initial analyses see Lehrer, Moore & Telfer, 1998).

Firstly, though, a quick look at the pilot data. Three hundred forty-six experienced pilots from five different international carriers and one U.S. institute completed the Pilot Learning Processes Questionnaire (PLPQ), a 30 item six point Likert scaled instrument which identifies Deep, Surface and Achieving approaches to learning. (See Moore, Telfer and Smith (1994) for validity and reliability of the scales.) In general terms, the results showed that pilots had a greater propensity to report Deep approaches to learning (mean scale score of 4.63 on the 1 to 6 scale), than Surface (mean scale score of 2.74) while Achieving perspectives (mean scale score of 3.93) were somewhat in between. The standard deviations for the three scales were in the range 0.42 to 0.59 indicating a reasonable distribution of scores around the means. Not unexpectedly in any analysis of individual differences, there were individuals who scored well above the mean on

individual scales as there were individuals who scored well below the mean for the various scales. In other words, a number of different profiles could be generated from the data with some pilots showing a higher propensity for Surface learning and lower Deep scores and so on.

The data from instructors were gathered from the Pilot Instruction Processes Questionnaire (PIPQ) which we developed (Moore, Lehrer & Telfer, 1997), again using the constructs of Deep, Surface, and Achieving and six point Likert-type items. With responses from over 220 instructors in the U.S., we were able to establish factorial validity for a 15-item version (three factors of Deep, Surface and Achieving) with reliabilities acceptable for a developing scale. Typical items from the revised questionnaire include: "Opportunities are provided to ensure that students really understand what they are being taught" (Deep); "I try to promote an expectation that those I instruct just need to pass" (Surface); and "Competition brings out the best in students" (Achieving). For the instructors, the mean scale score (range 1 to 6) was highest for Deep (4.95 with standard deviation of 0.56), then Achieving (3.70 with standard deviation of 0.61), and lowest mean scale scores for Surface (3.31, standard deviation of 0.69). However, as in the pilot sample, there were differences amongst individuals. For example, for Deep the highest individual scale score was 6.0, the lowest 2.40, the person with a mean of 6 clearly saw learning as being for understanding and instruction should be designed to accommodate that approach. For Surface the corresponding extremes were 5.60 and 1.00. An instructor with high scores like the 5.60 above, shows a strong emphasis towards a minimalistic approach of telling students what is to be learned and passing the test. So, in this sample there were individual instructors whose views and beliefs about instruction and learning were markedly different with others. Some reported instruction as being about developing pilots' understanding while others' perceptions were centered on just passing the examinations, and "how to do" not the "how and why."

COMPARISONS OF PILOTS AND INSTRUCTORS

Direct comparisons can be made between our pilot group and our instructor group on approaches to learning and instruction, although any interpretation needs to be tempered by the fact that the data were gathered from two different groups, that is the instructors were not those who instructed the pilots. (We anticipate conducting a study where the individuals all come from the one organization.)

The general profile across the three sub scales of Deep, Surface, and Achieving shows a similar trend for both pilots and instructors with the highest mean scale scores being for Deep (4.63 pilots, 4.95 instructors), the

lowest for Surface (2.74 pilots, 3.31 instructors) with Achieving in between (3.93 pilots, 3.70 instructors). The largest mean difference is between pilots and instructors on the Surface scale with almost a standard deviation difference suggesting that of the three scales, the Surface one differentiates the two groups most. Instructors seem more concerned than pilots about just passing examinations.

As indicated above, however, there were substantial differences in the profiles of individuals in both the pilot and instructor groups. Several hypothetical examples will help show the potential problems that can arise if there is a lack of appropriate alignment between those who instruct and those who are instructed. There are individuals in our data sets who reflect these profiles.

Pilot A has a profile on the PLPQ of high Deep (mean = 5.70), low Surface (mean = 1.90) and high Achieving (mean = 4.90). Here is a pilot who is very motivated to understand, to be competent and master the materials or tasks to be learned, and wants to do well against other pilots in the course. This pilot has a range of strategies for comprehensive learning while also recognizing there may be a role for Surface learning, but it is not the predominant approach. The predominant approach is Deep/Achieving (Understanding and doing well.).

Pilot B's PLPQ profile shows highest scores for Surface (mean = 4.90), and low scores for both Deep and Achieving (respective means = 2.80 and 2.20). Here is a pilot who is concerned about examinations (anxious), is only willing to do what is required to just get through and not the slightest bit more, and uses rote learning to have the material ready to regurgitate at the test. Pilot B is not so keen to succeed but does recognize to some extent that learning has to do with understanding. However, the dominant feature of the profile is the high Surface approach.

Instructor A's PIPQ profile shows high Deep scores (mean = 5.60), low Surface scores (mean = 1.80) and high Achieving scores (mean = 4.70). Here is an instructor who is keen on pilots gaining understanding through discussion, supplementary materials, and encouragement to study and do independent work. This instructor is not interested in having pilots just pass the test but encourages them to excel, seek perfection, and interact with others. This is a Deep/Achieving oriented instructor.

Instructor B has a PIPQ profile of low Deep (mean = 2.40), moderate Achieving (mean = 3.20) and high Surface (mean = 5.50). This instructor focuses on telling pilots what they need to do to pass the test and only instructs them to do so, nothing more. Little attention is given to understanding and learning for application in other situations. Instructor B is a Surface oriented instructor.

Now consider the consequences of these pilots and instructors working together. Take Pilot A and Instructor A. Clearly their approaches to learning are aligned in that they both are concerned with quality understandings, mastery, competence and overall, doing well against others. It is likely that the outcomes would be quality learning and greater motivation to continue learning due to the intrinsic rewards emerging from satisfaction with learning (and instructing). However, if we take Pilot B and Instructor B, we see that there is alignment (both are Surface oriented) but it is an alignment that the literature indicates will not produce quality outcomes, it is inappropriate. The focus for both will be on doing the minimal amount to pass the tests and while this may be important in itself, there is less likelihood that the learning will be enduring. (You may recall the experience of learning something only to pass a test and then having forgotten it almost immediately after the test was taken.)

The mixed profiles pose other problems due to the tensions of mismatches. What if Instructor B instructs Pilot A? The literature suggests that in this situation it is not likely the instructor will change (Henley, 1995). Pilot A may have to suffer the Surface approach of the instructor and in additional time do those Deep things to keep understanding in the foreground. It is conceivable, however, that if type B instructors consistently instruct pilots like Pilot A, these pilots may revert to Surface level strategies to survive the courses. [Recall our earlier reference to Biggs' (1999) comment that student approaches are reflective of the instructional environment.] Clearly such a reversion would be an undesirable state of affairs. What of the match between Pilot B and Instructor A? Again there is a mismatch but the literature is helpful here as it shows that an individual's approach to learning can be changed for the positive through instructional strategies reflective of the Deep and Achieving approaches (e.g., Moore, 1991). Some of the examples we give in the discussion below help show how deeper approaches can be encouraged by an instructor. What is apparent from these examples is that congruence at the high Deep/Achieving end is likely to produce better quality learning outcomes, problem solving abilities, and greater satisfaction (for pilot and instructor).

DISCUSSION

The lack of appropriate congruence between the approaches of instructors and trainees to training in aviation has major implications for key players: not only the check and training staff, and the pilots being trained, but the management of the organization needing to find the additional funds for over-hours training, and those executives who strive to establish a reputation for a well-managed operation.

Aviation management needs to develop the same acuity and sensitivity that leads an experienced pilot to automatically adjust out-of-sync engines. Understanding, professional judgement and long experience have provided a blueprint of the feel and sound of balanced power. As soon as a lack of synchronization occurs, there is an automatic reaction to correct it. Aviation organizations need to develop the same homeostatic response to differential values in the training department. Trainees and instructors have to be a collaborative team in order to achieved high quality training. Deep and Achieving are the aim points.

Why is such congruency vital? Because aviation organizations are working with adults as trainees, and adults learn in ways which are quite different from those which work with children at school. Many of the key approaches to adult education (or andragogy) cannot be achieved if the instructor lacks a deep and achieving approach or, worse, has only a surface approach (our Instructor B). There are three major training problems which result: *dislocated objectives; an emphasis on instruction rather than learning; and an application of pedagogy (child learning) rather than andragogy.*

Dislocated Objectives

In order to evaluate training in a reliable and valid way, it is necessary to consider the extent to which training objectives are attained. In other words, training departments look to see if there is any gap between what they say they are providing in training, and what trainees actually achieve. The only way to do this is to express objectives in terms of what the trainee has to know and do. These so-called *performance objectives* have to be based in learner terms. Something like: “*At the end of this sortie, the trainee will be able to...*”. What we often see in organizations with a surface approach to training is the objectives expressed in terms of what the instructor will do: “*Teach duties of pilot-flying...*” The key difference is that between instructing and learning. Without learning, there has been no training. Without learning, there will be a need for overflying the training syllabus.

Instruction rather than Learning:

Efficient learning occurs when we are taught what we do not already know. This implies a recognition that adults have different levels of experience and knowledge, which skilled instructors identify through questioning and other forms of testing (eg. Schiewe & Moore, 1997; Telfer, 1994). It costs training dollars when a standard course is presented regardless of trainees’ existing experiences and knowledge. A side effect is that the examples presented in either the training manuals or the instructor’s

presentation will not relate to the trainees' world. Rapport is diminished. The flow-on effects include a reduced likelihood of trainee questions, less awareness of trainee reactions, and an artificially-enhanced view of trainee feedback. This relates, too, to the way in which the overall training program is to be evaluated. To consider this we go to the final consideration: adult learning and its implications for training.

Andragogy, not Pedagogy

Adults are undertaking training to improve their skills and knowledge in application to their job. They need to know why they are learning something, where it applies, and how they expect it to improve their on-the-job performance. They are not simply completing exercises and sorties, exams, subject, tests and topics. Ticking the boxes is a poor substitute for real training. See the link with Deep and Achieving?

It follows that adult training is problem-based not subject-based. How does a surface-oriented training program present it?

This is what you need to know for the test.

It is in the manual...

It is on the video.

Watch the slides and complete the questions.

You need to get 80 percent on the multiple-choice test.

Questions from the instructor will tend to be closed and convergent:

What is the speed for.....?

How many miles out.....?

Quality learning has a crucial place for additional open and divergent questions:

Why does.....?

What would happen if....?

Consider this case study then tell me what you would do and why....?

In summary, instructors and trainees need to:

1. Speak the same language (figuratively as well as literally);
2. Start from where the trainee is;
3. Use the trainee's experiences, past and present;
4. Use questioning as a key activity;
5. Look at the big picture of training, examples from line activities, and applications on the job.

These activities can only occur when the training and testing program, instructors and trainees are in sync.

As noted above, challenges for management also arise from the notions of alignment and congruence. As Telfer (1997) notes, for effective training the dynamics of the organization have to be considered. Managers have control over factors such as resources, personnel, the syllabus, standards, licensing and testing. Their beliefs about learning will undoubtedly impact on each of these factors, where appropriate, and if manager beliefs are different from those of the instructors and pilots, there will be tensions that may reduce instructional and learning effectiveness. If management, for example, views learning of Crew Resource Management (CRM) as something to be done merely to satisfy a regulatory authority, then their commitment is likely to be more of a Surface orientation, the minimal amount of time and resources being made available for both instructors and pilots, cabin crew, maintenance crew etc. Under such conditions, it is not likely that quality instruction and learning will occur. Indeed, we would argue that managers need to be reflective about their beliefs about learning so that organizations can then consider appropriate alignment across all three levels, pilots, instructors and organization. Telfer and Moore (1997) indicate ways in which management can investigate its approaches to learning using the Deep, Surface, and Achieving constructs which have been a consistent theme of this paper.

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