

Recurrent human factors training should be more than a review of the initial course.

# Revisiting Human Factors

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BY ROBERT BARON

Recurrent training has long been a standard process in aviation, an attempt to make sure that skills once learned are retained and can be easily recalled when needed. In human factors (HF), however, recurrent training raises more issues than the relatively straightforward initial training.

The subject matter that should be covered in a recurrent course is not always obvious. Also, organizations may have trouble setting outcome objectives, which measure the effectiveness of the training and help shape or revise future courses. However, we can consult a pair of popular learning models.

Bloom's taxonomy<sup>1</sup> depicts six levels of cognitive activation in the learning process. They range from the lowest level,

*knowledge*, to the highest level, *evaluation*, with levels in between that are increasingly more complex and abstract (Figure 1, p. 44, and Table 1, p. 44).

Another theory, called the Kirkpatrick model,<sup>2</sup> uses four levels, each evaluating a specific type of learning that has occurred. These range from the lowest level, *reactions* to the course, to the highest level, *results*, with the intermediate levels measuring *learning* and *transfer* (Figure 2, p. 45, and Table 2, p. 45).

In terms of Bloom's taxonomy, HF initial courses typically are taught at the lowest two levels, knowledge and comprehension. In the Kirkpatrick model, most course objectives focus on the lowest levels, reactions and learning. After an HF initial course, the

student should be able, for instance, to recite the "dirty dozen" (DD), a group of human factors identified in a Transport Canada workshop, that can degrade individual performance — for example, complacency and distraction. The student also should be able to suggest types of personal or organizational influences that can lead to errors according to the DD categories.

The Kirkpatrick model's reactions and learning domains are measured using course evaluation sheets. Testing can include pre- and post-testing, individual subject tests throughout the course, or perhaps one final exam. Testing is an efficient way to find out what the students learned and if the training objectives have been met.

Recurrent HF courses should reach into higher levels of Bloom’s taxonomy, not simply recycle the initial course. The recurrent course is the perfect opportunity for students to work more abstractly with human factors topics.

The topics should be approached and discussed at the higher levels of Bloom’s taxonomy. The recurrent course is also ideal for discussing company-specific accidents and incidents.

Since the HF initial course, the student most likely has been able to apply his or her knowledge to error prevention strategies on the job. These strategies should now become part of the overall learning experience as students share anecdotes and information with the rest of the class.

Case studies and video re-enactments are useful in analysis. At this level, students should be able to thoroughly dissect the case study, employ logical deduction, and fully understand the accident chain and its implications.

Many students can relate to occurrences that happen in their “own backyard,” as opposed to generic material in the initial course. When used as case

studies, company-specific occurrences should focus on “why,” not “who.” As synthesis, students should be able not only to dissect the occurrence but also to recommend procedures to prevent recurrence. These mitigations may be policies, procedures and task cards, new or revised.

At the highest level of Bloom’s taxonomy, the student should be able to critically evaluate, compare and contrast error prevention strategies. Comparisons can be made among various error prevention methodologies. Methodologies that appear to be working can be retained, with others revised or updated.

In terms of Kirkpatrick’s highest level — results — the HF recurrent course is ideal for discussing the impact of learning on the organization. In this case, the HF facilitator might want to show the class the “big picture.” How has the HF training affected the rates of accidents,

incidents, errors, violations, occurrences and injuries? Is the trend moving in the right direction? If so, reinforcement of current practices may suffice. If not, why not? What can be done better?

If there is a problem with the organization, it should concern upper management. Unless upper management is represented in the class, a meeting with this group is in order. A successful HF training program — including recurrent training — that contributes to a reduction in accidents, incidents and injuries more than pays for itself. Even if the accident, incident and injury rates are steady or increasing, the training is not necessarily a failure; the trend might be worse without it.

The ideal recurrent course should focus more on abstract concepts and ideas than the initial course, including the safety “hot spots” in the organization and the aviation industry.

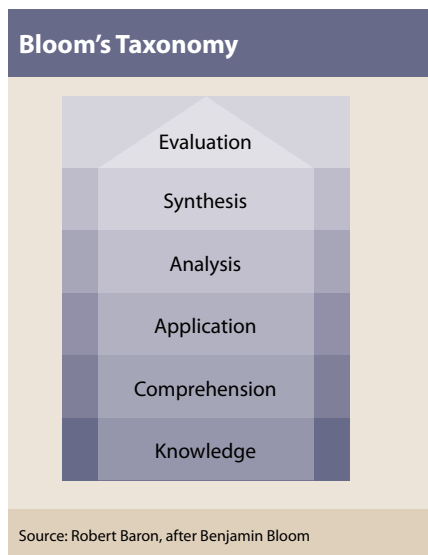
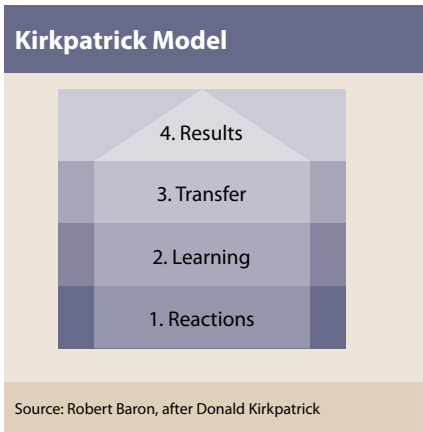


Figure 1

Bloom’s Taxonomy Level Examples	
Level	Examples
<b>Evaluation</b> Makes judgments about ideas or materials.	The student can evaluate, compare and contrast error prevention strategies.
<b>Synthesis</b> Builds a structure or pattern from diverse elements. Puts parts together to form a whole, with emphasis on creating a new meaning or structure.	The student can write new policies, procedures, task cards, etc. to reduce errors.
<b>Analysis</b> Separates material or concepts into components. Distinguishes between facts and inferences.	The student can diagnose an error by logical deduction.
<b>Application</b> Uses a concept in a new situation. Applies what was learned in the classroom to the job.	The student can apply error prevention strategies to the job.
<b>Comprehension</b> Understands the meaning of instructions and problems.	The student can explain the types of errors.
<b>Knowledge</b> Recalls information.	The student can recall the types of errors.

Source: Robert Baron, after Benjamin Bloom

Table 1



Source: Robert Baron, after Donald Kirkpatrick

Figure 2

Students should be able to explain the review topics in detail to the facilitator, rather than the other way around as with an initial course. New ideas and concepts should be introduced. The preferred delivery method for “soft skill” courses, such as HF, is face-to-face. Computer-based training is useful for technical subjects but not necessarily best where a high level of interaction between the facilitator and students is needed.

A recommended course outline for an HF recurrent course might look like this, in the suggested order:

**Review of the dirty dozen.** Presented creatively, the DD is an important anchor point for a review, since most errors occur because of one or more of the DD factors. Students already should be familiar with all 12 factors and be able to give examples of each, as well as what types of countermeasures they have used to trap an error. Each DD factor should be presented individually, with open discussion encouraged.

**Review of the SHELL model.** The SHELL model allows students to easily visualize the interface between the person, or *liveware*, and all of the peripheral error influences — software, hardware, environment and other *liveware*. Spend some time on this, because the SHELL model may be referred to throughout the course.

Kirkpatrick Model Level Examples

Level	Examples
<b>Results</b>	
The impact that learning has on the organization as a whole	Positive return on investment. Fewer accidents, incidents, errors, violations, occurrences, injuries, etc.
<b>Transfer</b>	
The transfer of what has been learned to the practical environment and the resultant change in behavior	Modification of behavior to mitigate and diminish errors (e.g., double checks to make sure no tools were left in the aircraft)
<b>Learning</b>	
The degree to which learning occurs as a result of the course	Testing at the conclusion of the course
<b>Reactions</b>	
A trainee’s reaction to the course	Course evaluation sheets

Source: Robert Baron, after Donald Kirkpatrick

Table 2

**Generic case studies.** The case studies may be delivered in a video or reading format. Video is the best delivery method, but written studies also can make the points. Case studies in the recurrent course should go beyond simple explanations and exhortations. At this level, students should be able to dissect the case study and offer substantive feedback about all the links in the accident chain.

**Company-specific human factors–related accidents and incidents.** The recurrent course is a unique opportunity to present company-specific, human factors–related accidents and incidents. These accidents and incidents tend to have a high level of “sticking power” in memory because of personal association.

**A review of the company’s overall safety statistics.** This material addresses the results level in the Kirkpatrick model. How has the learning affected the organization as a whole over time? Visuals such as bar charts and graphs are an ideal platform for presenting and discussing results. After presenting the data, the facilitator elicits open discussion. It is important for the facilitator to fully

understand the results and be prepared to offer guidance for improvements. If the results indicate an encouraging downward trend in accidents, incidents and injuries, the facilitator also should be prepared to reinforce the positive results and encourage students to keep the trend moving in that direction.

Working at the higher levels in Bloom’s taxonomy and the Kirkpatrick model will allow students to think in more abstract terms, increase their use of deductive logic, and fully understand the organization’s commitment to human factors training and the corresponding error reduction. ➔

*Robert Baron, Ph.D., is the president and chief consultant of the Aviation Consulting Group. He is also an adjunct professor at Embry-Riddle Aeronautical University and Everglades University, and teaches courses on aviation safety and human factors.*

Notes

1. The taxonomy was first presented in a 1956 book edited by Benjamin Bloom and is widely used in the educational field.
2. Donald Kirkpatrick’s model was published in a 1975 book, *Evaluating Training Programs*.