

Figure 2-4. Bloom's Taxonomy of the Cognitive Domain.

Higher Order Thinking Skills (HOTS)

The constructivist theory of learning explains and supports the learning of HOTS, which is commonly called aeronautical decision-making (ADM) in aviation. HOTS lie in the last three categories on Bloom's Taxonomy of Learning: analysis, synthesis, and evaluation skills. Teaching the higher level thinking skills which are essential to judgment, decision-making, and critical thinking is important to aviation because a common thread in aviation accidents is the absence of higher order thinking skills (see Appendix F).

HOTS are taught like other cognitive skills, from simple to complex and from concrete to abstract. 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.

It must be remembered that critical thinking skills should be taught in the context of subject matter. Learners progress from simple to complex; therefore, they need some information before they can think about a subject beyond rote learning. For example, knowing that compliance with the weight-and-balance limits of any aircraft is critical to flight safety will not help an aviation student interpret weight-and-balance charts unless he or she knows something about how center of gravity interacts with weight and balance.

If the student does not yet have much subject matter knowledge, draw on the student's experiences to gain entry into complex concepts. For example, most students probably played on a seesaw during their childhood. Thus, they have a basic experience of how weight and balance work around a center of gravity.

Additionally, 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.

Scenario-Based Training (SBT)

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 skills. SBT provides more realistic decision-making opportunities because it presents tasks in an operational environment; it correlates new information with previous knowledge, and introduces new information in a realistic context.

SBT is a training system that uses a structured script of "real world" scenarios to address flight-training objectives in an operational environment. Such training can include initial training, transition training, upgrade training, recurrent training, and special training.

The instructor should adapt the scenarios to the aircraft, its specific flight characteristics and the likely flight environment, and should always require the student to make real-time decisions in a realistic setting. The scenarios should always be planned and led by the student (with the exception of the first flight or two or until the student has developed the required skills).

SBT not only meets the challenge of teaching aeronautical knowledge to the application level of learning, but also enables the instructor to teach the underlying HOTS needed to improve ADM. The best use of scenarios draws the learner into formulating possible solutions, evaluating the possible solutions, deciding on a solution, judging the appropriateness of that decision and finally, reflecting on the mental process used in solving the problem. It causes the learner to consider whether the decision led to the best possible outcome and challenges the learner to consider other solutions.

SBT scenarios help learners better understand the decisions they have to make and also helps focus the learner on the decisions and consequences involved. It is being used to train people in everything from emergency response to hotel management. The strength of SBT 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 goal is reached 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.

SBT has become one of the primary methods to teach today's aviation learners how to make good aeronautical decisions which in turn enhances the safety of all aviation related activities. For information on how to incorporate SBT into a training syllabus, refer to chapter 9.

Perceptions

Initially, all learning comes from perceptions, which are directed to the brain by one or more of the five senses: sight, hearing, touch, smell, and taste. Psychologists have also found that learning occurs most rapidly when information is received through more than one sense. [Figure 2-5]

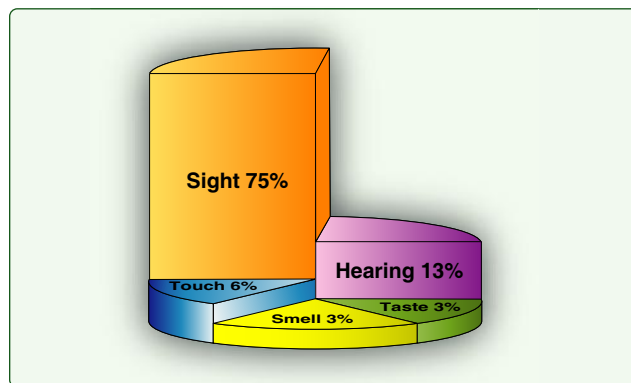


Figure 2-5. Most learning occurs through sight, but the combination of sight and hearing accounts for about 88 percent of all perception.