I.B. The Learning Process

Objectives	The student should develop knowledge of the elements related to the learning process as required in the CFI PTS.
Elements	✈ Learning Theory ✈ Perceptions and Insight ✈ Acquiring Knowledge ✈ The Laws of Learning ✈ Domains of Learning ✈ Characteristics of Learning ✈ Acquiring Skill Knowledge ✈ Types of Practice ✈ Scenario Based Training ✈ Errors ✈ Memory and Forgetting ✈ Retention of Learning ✈ Transfer of Learning ✈ Levels of Learning
Schedule	1. Discuss objectives 2. Review material 3. Development 4. Conclusion
Equipment	✈ White board ✈ Markers ✈ References
Instructor's Actions	1. Discuss lesson objectives 2. Present lecture 3. Questions 4. Homework
Student's Actions	Participate in discussion Take notes
Completion Standards	Understand the learning process. Can integrate knowledge when instructing students.

References	FAA-H-8083-9, *Aviation Instructor's Handbook* (Chapter 2)

Instructor Notes

Introduction	Overview—review objectives and elements Why—understanding how people learn and how to apply that knowledge is the basis for effective teaching.
The learning theory	Body of principles advocated by psychologists and educators to explain how people acquire skills, knowledge, and attitudes.
Behaviorism	Explains behavior in terms of observable and measurable responses to stimuli. Positive reinforcement. Stresses importance of having a particular form of behavior reinforced by someone other than the student (i.e. instructor) to shape and control what is learned, rather than no reinforcement or punishment.
Cognitive theory	Focuses on what is going on inside the student's mind. Learning isn't just a change in behavior; it is a change in the way a student thinks/understands/feels. Two Major Branches of the Cognitive Theory ✈ The Information Processing Model The student's brain has internal structures which select and process incoming material, store/retrieve it, use it to produce behavior, and receive/process feedback on the results. ✈ The Social Interaction Theory Stress that learning and subsequent changes in behavior take place as a result of interaction between the student and the environment The social environment to which the student is exposed demonstrates or models behaviors, and the student cognitively processes the observed behaviors and consequences. Techniques for learning include direct modeling and verbal instruction Behavior, personal factors, and environmental events all work together to produce learning. ✈ Both models have common principles They both acknowledge the importance of reinforcing behavior and measuring changes. Some means of measuring student knowledge, performance, and behavior is necessary.
Behavioral and cognitive	Plan, manage, and conduct aviation training with the best features of each theory. Provides a way to measure the behavioral outcomes and promote cognitive learning.

Perceptions	Initially, all learning comes from perceptions directed to the brain by one of the senses. Perception—student gives meaning to sensations. Instructor should direct perceptions initially so that student perceives relevant information—new students are overwhelmed by stimuli and often focus on meaningless things, missing the key information. Meanings, derived from perceptions, influenced by experience and other factors.
Factors that affect perception	Internal and external. Physical organism, goals and values, self-concept, time and opportunity, element of threat.
Physical organism	Provides students with the perceptual apparatus for sensing the world around them.
Goals and values	Every experience is colored by the student's values and beliefs. Things that are more highly valued and cherished are pursued; those accorded less value/importance are not sought after.
Self-concept	Powerful determinant in learning. Confident or insecure. If a student's experiences tend to support a favorable self-image, the student tends to remain receptive to subsequent experiences. Negative experiences—tendency to reject additional training. Negative self-concept inhibits perceptual process by introducing psychological barriers that keep the student from perceiving.
Time and opportunity	Proper sequence and time are necessary for learning.
Element of threat	Does not promote effective learning. Limits attention to the threatening object/idea. Ineffective.
Insight	The mental relating and grouping of associated perceptions into meaningful wholes. One of instructor's main responsibilities—help the student understand how each piece relates to the others. As perceptions increase, students develop insight by assembling them into larger blocks of learning—learning becomes more meaningful and more permanent
Acquiring knowledge	Three phases: memorization, understanding, concept learning. Part of an instructor's job.

Memorization	A student's first attempt to acquire knowledge about a topic. Memorizing facts about steps in a procedure. Allows students to get started quickly. Not useful for solving problems or providing explanations of something not covered by newly acquired knowledge.
Understanding	The ability to notice similarities and make associations between facts and procedural steps learned. Learner begins to organize knowledge in useful ways and a collection of memorized facts gives way to understanding. Advantages of understanding: learner no longer limited to answering questions that match memorized facts, have an easier time mastering variations of the processes, understanding shared between people allows them to communicate more efficiently, and easier to remember or reconstruct procedure steps.
Concept learning	Based on the assumption that humans tend to group objects, events, ideas, people, etc. that share one or more major attributes that sets them apart. Enhances student understanding when students formulate generalized concepts from particular facts or steps. Schema: the cognitive framework that helps people organize and interpret information. Helps learners interpret things they observe by priming them to expect certain elements that match the schema (ATC communications example). Help humans deal with information, but make it difficult to retain new information that does not conform to established schemas.
The laws of learning	Principles of learning provide additional insight into what makes people learn most effectively. **REEPIR**
Readiness	Individuals learn best when they are ready to learn. If students have a strong purpose, clear objective, and a definite reason for learning, they make more progress than if they lack motivation. The basic needs of the learner must be satisfied before they are ready/capable of learning. The instructor can do little to help if needs not met. The learner must want to learn the task being presented and must possess the requisite knowledge and skill. Instructor actions: ✈ Communicate a clear set of learning objectives to the student and relate topic to objectives. ✈ Introduce topics in logical order and leave students with need to learn next topic.

	Teachable moment: moment of educational opportunity when student is particularly responsive to being taught something.
Effect	Learning is strengthened when accompanied by a pleasant or satisfying feeling. Learning is weakened when associated with unpleasant feeling. Always include elements that affect the student positively and give them a feeling of satisfaction in instruction.
Exercise	Things most often repeated are best remembered. Connections are strengthened with practice and weakened when practice is discontinued.
Primacy	Creates a strong, almost unshakable impression. Teach correctly the first time, student must learn correctly the first time. Relearning is more difficult than initial training. The first experience should be positive, functional, and lay the foundation for all that is to follow.
Intensity	A vivid, dramatic, or exciting learning experience will teach more than a routine or boring experience. Real world applications teach better than substitutes. Use imagination in approaching reality as closely as possible.
Recency	Things most recently learned are best remembered. Repeat, restate, or reemphasize important points at the end of a lesson to help in remembering. Determines sequence of lectures within a course of instruction.
Domains of learning	Bloom classified major areas of learning and thinking into three large groups: cognitive (thinking), affective (feeling), and psychomotor (doing).
Cognitive	Includes remembering facts and concepts that help develop intellectual abilities and skills. Four practical learning levels: rote, understanding, application, and correlation. ✈ Rote learning: lowest level of learning; ability to repeat something which one has been taught, without understanding or being able to apply what has been learned. *[define, identify, label]* ✈ Understanding: puts two or more concepts together. *[describe, estimate, explain]* ✈ Application: puts two or more concepts together to form something new. *[determine, develop, solve]*

	✈ Correlation: student becomes able to associate an element which has been learned with other segments or blocks of learning. Objective of aviation instruction. Educational objective levels: knowledge, comprehension, application, analysis, synthesis, evaluation.
Affective	Addresses learner's emotions toward the learning experience—how the student approaches learning. Levels of teaching: awareness, response, value, organizing, and integration Educational objective levels: receiving, responding, valuing, organization, characterization.
Psychomotor	Skill-based—includes physical movement, coordination, and use of the motor-skill areas. Requires repetitive practice, and is measured in terms of speed, precision, distance, and techniques. E.g. programming a GPS, flying an approach. Levels of teaching: observation, imitation, practice, and habit. Habit level reached when student can perform the sill in twice the time that it takes an instructor/expert to perform. As physical tasks and equipment become more complex: increased requirement to integrate cognitive and physical skills. Educational objective levels: perception, set, guided response, mechanism, complex overt response, adaptation, origination.
Characteristics of learning	To be effective, the learning situation should be purposeful, based on experience, multifaceted, and involve an active process. **PRMA**
Purposeful	Student's past experiences affect readiness to learn and understanding of requirements involved. Students have specific intentions and goals and learn from any activity that tends to further their goals. Needs and attitudes may determine what students learn. Student's goals are of paramount significance—to be effective, instructors need to find ways to relate new learning to student's goals.
Result of experience	Student can only learn from personal experiences. Previous experiences condition student to respond to some things and ignore others. Instructors must provide learning experiences that are meaningful, varied, and appropriate. Effective experiences challenge the student, and require involvement with feelings, thoughts, memory of past experiences, and physical activity. Students need learning experiences that involve knowledge of general principles and require use of judgment in solving realistic problems if they are to use sound judgment and develop decision-making skills.

Multifaceted	Learning process may include verbal, conceptual, perpetual, emotional, and problem-solving elements simultaneously. Incidental learning—students may be learning other things as well, while learning the subject at task. They may be developing attitudes about aviation, learning self-reliance, etc.
Active process	Learning is a process of changing behavior; therefore, process must be active. For students to learn, they need to reach and respond (outwardly, inwardly, emotionally, or intellectually).
Acquiring skill knowledge	Skill knowledge—knowledge reflected in motor/manual skills and in cognitive/mental skills that is manifested in the doing of something. Based on extensive practice which leads to storage of skill knowledge. Acquired slowly through related experience.
Stages of acquiring a skill	Three stages help the student transition from beginner to expert. The instructor must be able to recognize each stage in student performance to assess student progress. ✈ Cognitive stage ✈ Associative stage ✈ Automatic response stage
Cognitive stage	Basis in factual knowledge—the student memorizes the steps to a skill and carries them out, often unaware of progress, or while fixating on one aspect of performance. Requires all the student's attention—distractions often cause performance to deteriorate or stop. Provide a clear, step by step example as a model to follow, which will help students get a clear picture of each step in required sequence. Provide demonstration, emphasizing steps and techniques.
Associative stage	Practice begins to store the skill. The student gains proficiency through practice. Long, detailed explanations can be confusing before the student begins performing—specific comments are more meaningful/useful after the skill has been partially mastered. The student learns to associate individual steps in performance with likely outcomes, and can assess progress and make adjustments instead of simply repeating the steps. Performing the skill still requires deliberate attention, but the student can deal with distractions better.
Automatic response stage	The skill becomes automatic through practice and requires less attention, allowing the student to focus on other aspects of flight, as well. Student performance is rapid and smooth, with fewer and

	smaller adjustments. The student may no longer be able to remember the individual steps in the procedure or explain how to perform the skill.
Knowledge of results	Make certain that the student is aware of their progress; when they are right and when they are wrong. Tell them as soon after the performance as possible—do not allow them to practice mistakes. It is hard to unlearn mistakes.
How to develop skills	Progress tends to follow a power law of practice—the speed of performance of a task improves as a power of the number of times the task is performed. Practice improves performance. Learning progress proceeds at a fast pace initially and slows down as performance becomes more skilled.
Learning plateaus	Normal part of the learning process. Tend to be temporary, but be prepared for them. The student may have reached capability limits, may be consolidating levels of skill, interest may have waned, may need a more efficient method for increasing progress. The instructor can bring on a plateau by overpractice. Give it a break after 3-4 times. Move the student to a different place in the curriculum.
Types of practice	Continue practice once the student learns the skill to improve retention. How practice is structured impacts how well the student will retain what they have learned.
Deliberate	To gain skill knowledge and learn how to perform the skill on the automatic level. Aimed at a particular goal. The student practices specific areas for improvement and receives specific feedback after practice. Focus on eliminating discrepancies between actual performance and performance goal sought. Avoid distractions. Feedback should be brief and explicit. Do not introduce new ideas, do not prompt the student to think about old ideas in different ways. Examples: landings, stalls, steep turns, procedure flows.
Blocked	Practicing the same drill to make movement automatic. Leads to better short-term performance but poorer long-term learning. Enhances current performance but does not improve concept learning or retrieval from long-term memory.
Random	Mixes up the skills to be acquired throughout the practice session. Leads to better retention because the student starts to recognize the similarities and differences of each skill, making it more meaningful.

	Can store skill more effectively in the long-term memory. Retrieves steps and parameters from long-term memory, helps students recognize patterns between tasks.
Scenario based training	Scenarios that resemble the environment in which knowledge and skills may be used later. Useful to learning. A good scenario has a good set of objectives, is tailored to the needs of the student, and capitalizes on the nuances of the local environment. A good scenario is not a test, will not have a single correct answer, does not offer an obvious answer, engages all three learning domains, is interactive, should not promote errors, and should promote situational awareness and opportunities for decision-making.
Errors	Natural part of human performance. Two kinds: slips and mistakes.
Slip	Occurs when a person plans to do one thing but inadvertently does something else. Errors of action.
Mistake	Occurs when a person plans to do the wrong thing and is successful. Errors of thoughts. Often the result of gaps or misconceptions in the student's understanding.
Reducing error	It is impossible to eliminate errors entirely, but we can try to reduce them.
Learning and practicing	First line of defense—higher levels of knowledge and skill are associated with a lower frequency/magnitude of error.
Taking time	Work deliberately at a comfortable pace.
Checking for errors	Actively look for evidence of errors. Check the work, look for new ways of checking the work.
Using reminders	Visible reminders help reduce error. E.g. checklists, published procedures. Some instruments (e.g. altimeters) may have bugs to remind the pilot about assigned altitude, heading, etc. Use a notepad to write down reminders.
Developing routines	Standardized procedures help reduce error. Adopt standardized procedures even when checklists are unavailable or impractical.
Raising awareness	Be mindful when operating in conditions under which errors are known to happen or in conditions under which defenses against errors have been compromised.

Error recovery	Learn and practice lost procedures to ensure that the student can recover from the situation in which they have lost their way. Prepare for other common student errors.
Learning from error	Error is a valuable learning resource. Ask why it happened and what could be done different. There is a tendency to "explain away" errors and to dismiss them as one-time events, resisting learning from them.
Memory and forgetting	Memory links learning and applying what is learned. Ability to encode, store, and retrieve information. Widely accepted memory model with three components: sensory memory, short-term memory, and long-term memory.
Sensory memory	Part of the memory system that receives initial stimuli from the environment and processes them according to our preconceived concept of what is important. Factors influencing reception—dramatic input that impacts more than one of the five senses makes information more likely to impress. Precoding—selective process where the sensory register recognizes particular stimuli and immediately transmits them to the short-term memory for action.
Short-term memory	Working memory. Part of memory where information is stored for ~30seconds, after which it either fades rapidly or is consolidated into the long-term memory. Time/capacity limited. Rehearsal/repetition and sorting/categorization into chunks (coding) can help retention. Learning begins to take place when coding process involves recoding to adjust info to individual experiences.
Long-term memory	Information stored for future use. The more effective the coding process, the easier the recall. One of the major responsibilities of the instructor—help students use their memories effectively.
Theories of forgetting	Loss of memory; typically involves a failure in memory retrieval. RID—repression, interference, disuse
Retrieval failure	The inability to retrieve information—failure to store. Caused by not encoding information well and the information not making it to long-term memory.
Fading	We forget information that is not used for an extended period of time—fades away or decays.

Interference	An experience may overshadow a memory or the learning of similar things has intervened. New events displace things that had been learned.
Repression or suppression	Memories pushed out of reach because we do not want to remember the feelings associated with it. Repression is unconscious, suppression is conscious. Information may still be there, just inaccessible.
Retention of learning	Make sure the student's learning is readily available for recall by teaching thoroughly and with meaning. ✈ Praise stimulates remembering. ✈ Recall is promoted by association. ✈ Favorable attitudes aid retention. ✈ Learning with all senses is most effective. ✈ Meaningful repetition aids recall.
Transfer of learning	Degree of transfer involved in all learning since all learning is based on prior learned experience. People interpret new things in terms of what they already know. Positive transfer—learning of skill A helps to learn skill B Negative transfer—learning of skill A hinders the learning of skill B To achieve positive transfer… ✈ Plan for transfer as a primary objective. ✈ Ensure the student understands that what they are learning can be applied in other situations. ✈ Maintain high-order learning standards. ✈ Provide meaningful learning experiences that will build confidence in the ability to transfer learning. ✈ Use material that helps form valid concepts and generalizations by making relationships clear.
Building block technique of instruction	New learning and habit patterns are based on a solid foundation of experience and/or old learning. As knowledge and skills increase, there is an expanding base upon which to build for future learning.
Levels of learning	Four basic levels Rote learning—the ability to repeat something that was taught without understanding it or being able to apply it. Understanding—the student consolidates old and new perceptions into an insight on a subject or maneuver. Application—the student understands and practiced until consistent. Correlation—the student can correlate what has been learned with things previously learned or subsequently encountered. The objective of aviation instruction!

Conclusion	Brief review of main points. Instruction in aviation should utilize a combination of learning theories. Help the student make insights and transfer knowledge to the long-term memory.

CFI PTS

Objective: To determine that the applicant exhibits instructional knowledge of the learning process by describing:

1. Learning theory.
2. Perceptions and insight.
3. Acquiring knowledge.
4. The laws of learning.
5. Domains of learning.
6. Characteristics of learning.
7. Acquiring skill knowledge.
8. Types of practice.
9. Scenario-based training.
10. Errors.
11. Memory and forgetting.
12. Retention of learning.
13. Transfer of learning.

Remember types of errors—slips vs mistakes

Law of primacy

Repetition—don't overdo it, 5-6 landings are sufficient, anything more than that will frustrate the student.

Levels of understanding—student pilot's level is rote, they are doing what they are told. Private pilots apply the skills in their mind. Commercial pilots correlate it.

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