Fundamentals of Instruction

The Learning Process

Objective

Understand the learning process and apply the information to provide effective flight and ground instruction.

Motivation

An competent instructor uses knowledge of the learning process and human behavior to structure effective training and ensure students are progressing.

Overview

- Definitions of learning

- Learning theories (Behaviorism, Cognitive)

- Perceptions and insight

- Levels and laws of learning

- Domains of learning

- Scenario-based training

- Acquiring skill knowledge and practice types

- Evaluation, critique, and error management

- Memory, retention, and forgetting

- Transfer of learning

Definitions of Learning

- A process resulting in a change in behavior
  - This change by be good or bad, fast or slow
- Gaining knowledge or skills through study, instruction, or experience

Learning Theory in Instruction

Behaviorism

- Oldest theory of learning

- Behavior explained as observable responses to stimuli

- Human behavior is conditioned by environmental events

- "Carrot-and-stick" approach to learning

- Humans are complex, thinking creatures however

 - Modern theories of learning de-emphasize this approach
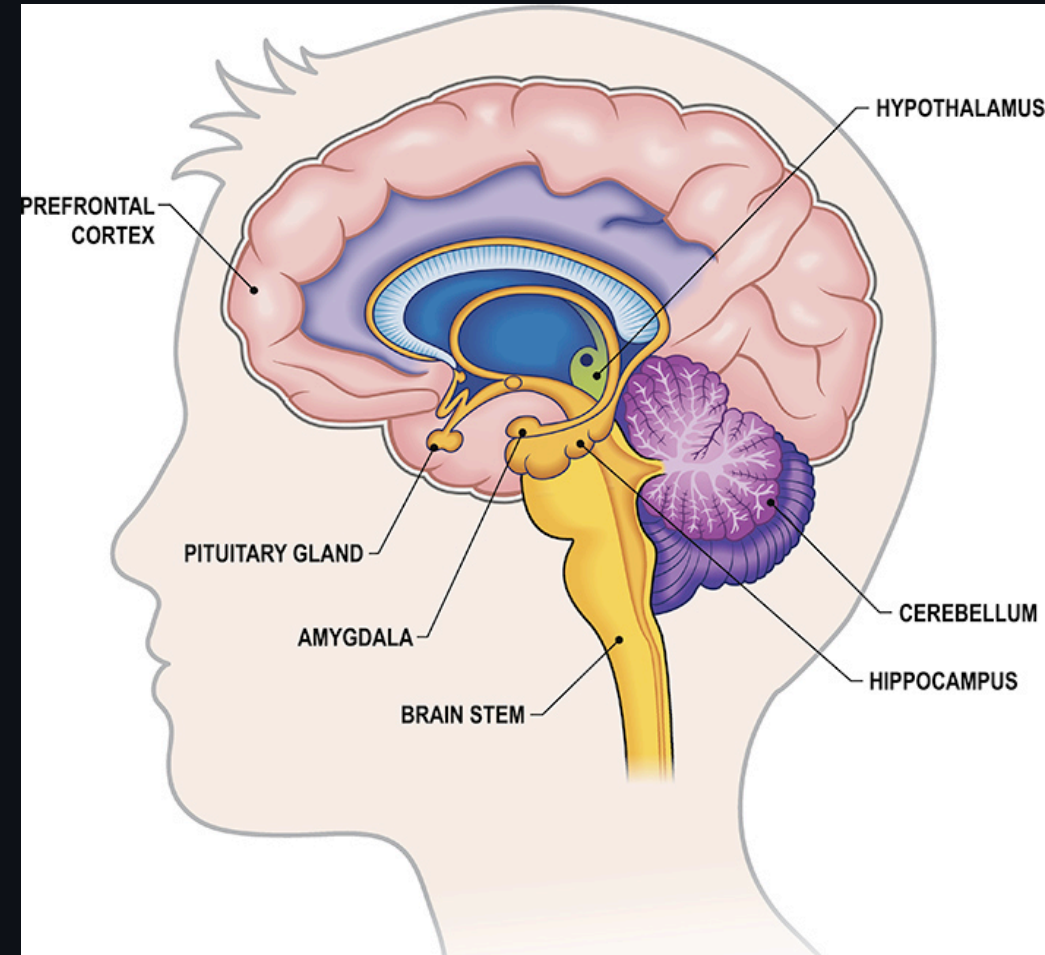
Cognitive Theory
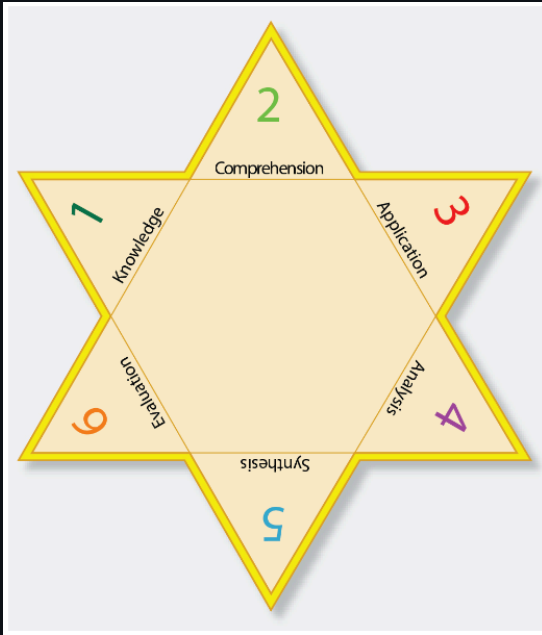
- Focuses on internal mental processes
- Involves reflection, problem-solving, and critical thinking
- Learning is not just a change in behavior, but also a change in the way a learner thinks, understands, or feels
- Notable cognitive theories:
  - John Dewey: Reflective thought is where effective learning occurs
  - Jerome Bruner: Known to the unknown, or from the concrete to the abstract
  - Benjamin Bloom: Bloom's taxonomy, simple to complex continuum

Perceptions
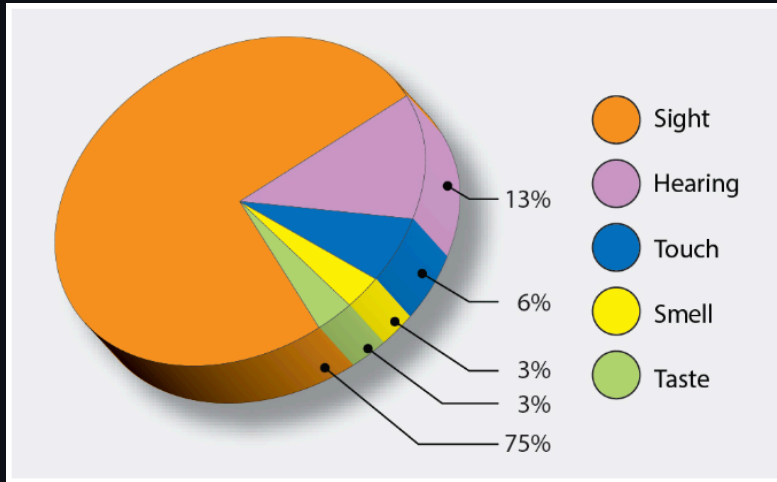
- Perception is sensory input that is interpreted by the brain
- The process of learning involves mapping this new sensory input into useful information
- Filtering and extracting meaning from sensory input comes from experience
- Perceptions can involve all sense
  - Learning is most effective when more than one sense is involved

Factors that Affect Perception

- Physical organism
  - The physical apparatuses for sensing the world around us
- Goals and values
  - Sensory input is colored by one's own beliefs and values, goals are the produce of one's value structure
- Self-concept
  - Self image (e.g. confident, insecure), affects a persons perception
  - Negative experiences can contradict a person's self-concept

Factors that Affect Perception

- Time and opportunity
    - We need time and practice to develop perception of something
- Element of threat
    - Fear adversely affects perception by narrowing the perceptual field
    - An overwhelming situation can be threatening
    - If a learner feels they can handle a situation, then it's viewed as a challenge

Perceptions and Insight

- Insight: Grouping perceptions into meaningful wholes
- Instructors guide learners to synthesize perceptions into insights
- Example: Steep turns
  - Sight picture
  - Propeller and engine noise
  - G-force
  - Feel on the controls

Acquiring Knowledge

Levels of Learning

- **Rote:** Memorization, first attempt
- **Understanding:** Making associations, building mental models
- **Application:** Using knowledge meaningfully in context
- **Correlation:** Generalizing concepts, forming schemas

Thorndike's Laws of Learning

- **Readiness:** Student must be motivated and ready
  - Basic needs are met (remember our hierarchy of needs)
- **Exercise:** Practice is essential
  - Repetition is necessary to form insight, habits, automatic responses
- **Effect:** Positive experiences reinforce learning
  - Negative experiences hinder learning, induce stress, promote negative self-concept

Thorndike's Laws of Learning (continued)

- **Primacy:** First-learned is best remembered
  - First impression are solidified and difficult to un-learn

- **Intensity:** Vivid and realistic experiences are retained better
  - The more real or intense a situation is, the better it will be remembered

- **Recency:** Most recent information is remembered best
  - The reason behind recurrent training

Laws of Learning – Example

Intensity:

A flight instructor random simulates an engine failure during a training flight when the student is not expecting it. The student will remember emergency procedures much better than if covered in a lecture.

Recency:

Briefing a takeoff emergency before each flight gives you the best chance on remembering the procedure if a real emergency were to occur.

Domains of Learning

Major areas of learning and thinking, developed by Dr. Bloom

- **Cognitive:** "Thinking" - Recall, understanding, application

- **Affective:** "Feeling - Attitudes, emotions, values.

- **Psychomotor:** "Doing" - Physical skills, habits, muscle memory

Domains of Learning – Example

Cognitive:

A student can recite the VFR weather minimums for classes of airspace, the reasons they exist, and how to use them in different scenarios.

Affective:

A student likes their instructor, is motivated to learn, and excited about aviation. They are therefore more willing and open to learning.

Psychomotor:

A student practices and refines the physical skills required for a flare to landing. They adjust their timing and pressure until it become automatic, not requiring deliberate thought.
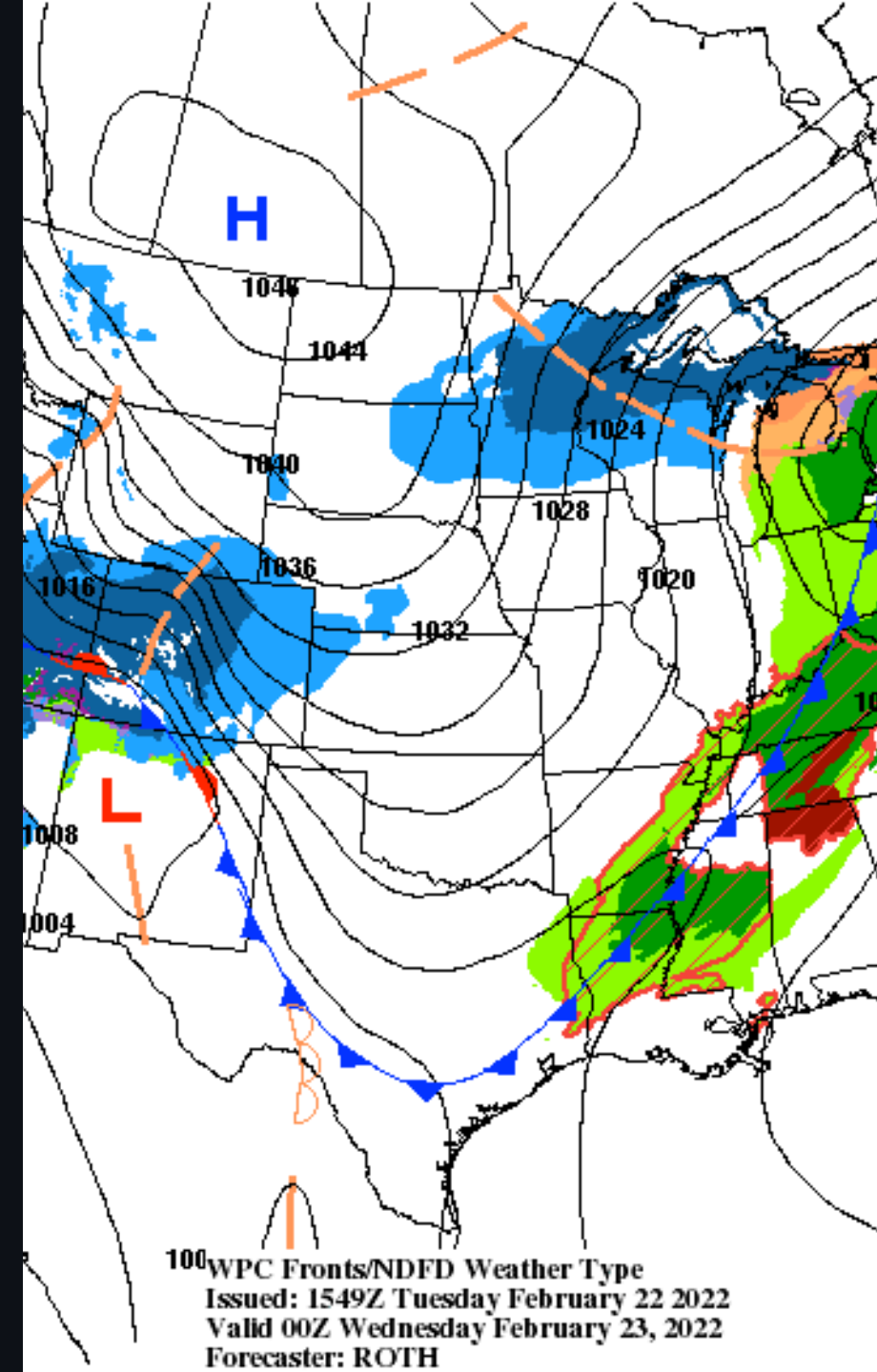
Characteristics of Learning

- **Purposeful**
  - Learners seek relevance, colored by a person's experience
- **Result of Experience**
  - Built from prior experiences
- **Multifaceted**
  - Involves many elements, not always intended
  - Involves information in different form
- **Active Process**
  - Not a passive process
  - Requires continuous engagement

Scenario-Based Training (SBT)

- Uses real-world scenarios to meet training objectives

- Supports understanding, application, and correlation

- Helps students apply past experiences and strengthen decision-making

- Supports *decision objectives* of training

WPC Fronts/NDFD Weather Type
Issued: 1549Z Tuesday February 22 2022
Valid 00Z Wednesday February 23, 2022
Forecaster: ROTH

Acquiring Skill Knowledge

Stages

1. **Cognitive:** Initial attempt, rote and understanding levels

2. **Associative:** Practice, self-assessment, critique by instructor

3. **Automatic Response:** Skill becomes smooth and automatic

How to Develop Skills

- Repeated, focused practice transitions skills from effortful to automatic

- Early attempts are often awkward and slow, becoming easier and smoother

- "Power law of practice": Speed of a task improves as a power of the number of times that the task is performed

Knowledge of Results

- Feedback should be early and frequent

- Students should learn to judge their own performance

Learning Plateaus
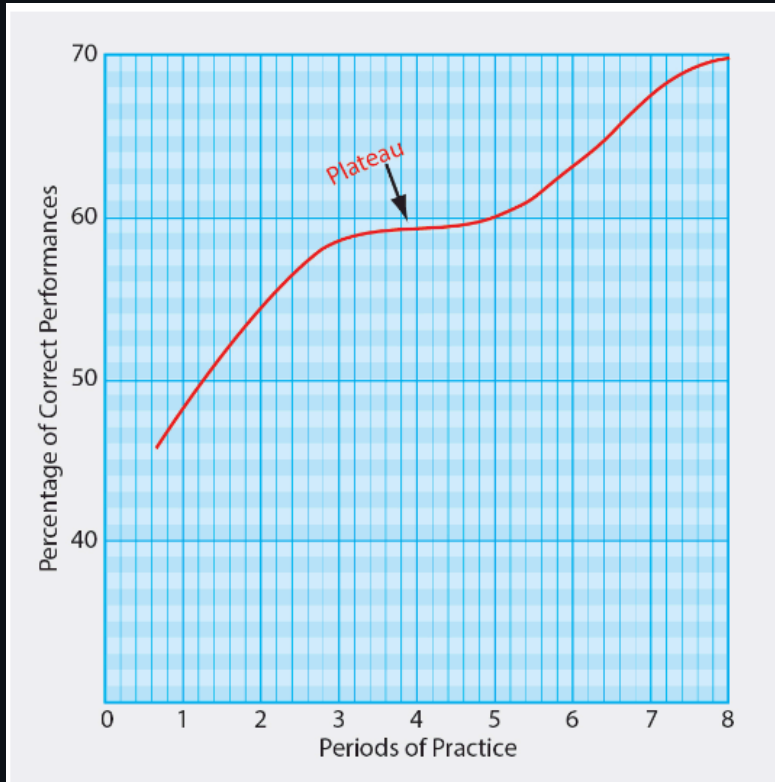
- May result from consolidation, waning interest, or cognitive limits
- May require new practice methods to overcome
- Ways to approach learning plateaus
  - Transition to working on another skill
  - Have a student work with another instructor

Types of Practice

- **Deliberate:** Goal-oriented, with feedback
  - A typical lesson with an instructor with stated goals
- **Blocked:** Repetitive, short-term memory
  - Typical solo student landing practice
- **Random:** Varies tasks, best for long-term retention
  - A ground session with an instructor who will quiz on lots of different topics

Evaluation vs Critique

- **Critique**: Providing immediate, actionable feedback to a student as a skill is being performed
  - Includes positive and negative feedback
  - Most useful early in training
- **Evaluation**: More holistic test where a skill is evaluated from start-to-finish, and completion standards are used
  - More useful in later stages of training
  - Example: Checkride, stage check

Distractions, Interruptions, Fixation, Inattention

- Minimize distractions early in training
  - Introduce them as a students progress
- Teach task prioritization over time
  - Ensure students can perform each task individually before combining it
- Fixation: Over/under-focusing on information
- Inattention: Missing important cues

Errors

- **Slip:** Right intention, wrong action.
- **Mistake:** Wrong intention.
- Minimize errors by taking time, using checklists, developing routines, and raising awareness.
- Instructors should help students recover and learn from errors.

Errors – Example

Slip:

A student intended to raise the flaps after the go-around, but go distracted looking for traffic.

Mistake:

A student believes the traffic pattern altitude is 1,000 feet MSL at all airports, but it's really 1000' AGL.

Memory

- Sensory Memory
  - Receives initial stimuli, filters for importance
  - Based on person's values/experience
- Short-Term Memory (STM)
  - Holds info for ~30 seconds
  - Encoding required for long-term storage
- Long-Term Memory (LTM)
  - Permanent, infinite storage
  - Recall involves reconstructing
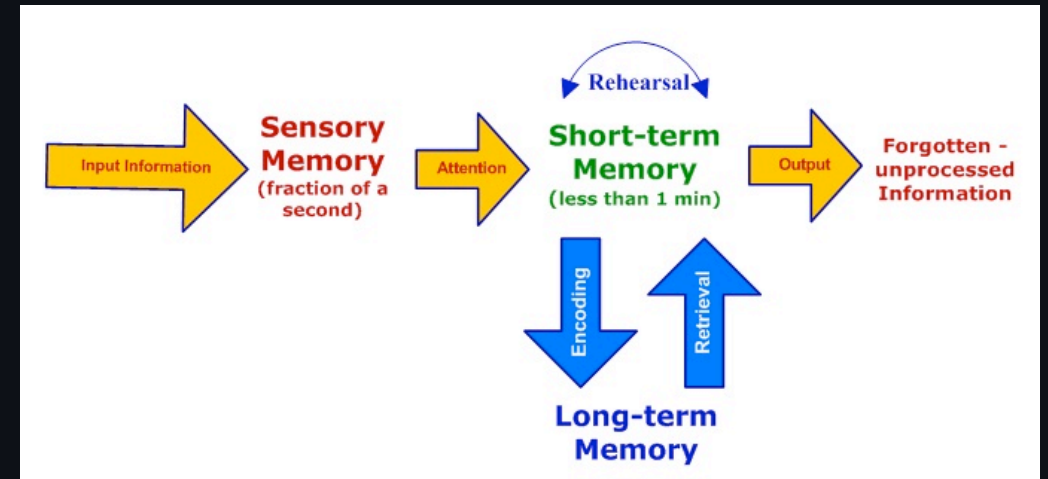
How Usage Affects Memory

- Repetition and meaningful association improve retention

- "Depth of processing" - Deeper thinking helps improve memory and retention

- Another reason for using multi-faceted, multi-sensory learning experiences

Forgetting

- **Fading**
  - Information fades over time (remember repetition and recency)
- **Retrieval Failure**
  - "Tip of the tongue" forgetting in the moment, may be temporary
- **Interference**
  - Similar, more recent information may confuse older information
- **Suppression**
  - Subconscious may block unpleasant memories from surfacing

Retention of Learning

- Praise and positive attitudes aid memory - Law of Effect
- Association and repetition help recall
  - Another reason for striving for understand, application, correlation levels of learning
- People learn and remember only what they wish to know
- Learning with all senses is most effective
- Use mnemonics (ATOMATOFLAMES)

Transfer of Learning

- Applying existing knowledge to new situations
- Near/Far
  - **Near Transfer:** Apply in similar context
  - **Far Transfer:** Apply knowledge in different context, but with some shared structure
- Positive/Negative
  - **Positive Transfer:** Previous learning helps new learning
  - **Negative Transfer:** Previous learning interferes with new learning

Transfer of Learning – Examples

Near Transfer:

A student who has learned to land a Cessna 172 applies the same landing technique to a Cessna 182.

Far Transfer:

Seeing a new taxiway sign that you've never seen before, but shares commonalities with ones you have seen.

Transfer of Learning – Examples

Positive Transfer:

Using skills flying shallow turns to help with steep turns.

Negative Transfer:

Trying to steer on the ground with the yoke instead of the rudder pedals, a skill transferred from driving a car.

Summary

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- Domains of learning

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