Schema Theory of Learning

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Learning Goals

• Understand the concept of a schema and how they influence perception.
• Understand how schemas relate to instructional practices.
Memory

• Memories tend to include much inaccurate information
  – Inaccuracies in memory are systematic and predictable
  – Memories depend on prior experience
    • Illustration: Memory for people in attendance at lecture

Inaccurate memories can be explained by the concept of a *schema*.
  – **Schema**: Structure for representing concepts in memory

**Schema Theory**: Theory of how knowledge is represented and how the representation of knowledge guides the application of knowledge
  – Incoming information from the environment is organized around previously developed schema
Memory

• Recall of information depends on:
  – Quality of schema organization
    • Better quality, better memory
  – How typical the event
    • More typical, more errors

Schema

• Schemas are like:
  – **Dramas**: Schemas provide the script where the variables (aka characters, setting, and action) are unique to each performance
  – **Theories**: Interpret phenomenon and make predictions about unobserved events
  – **Procedures/Algorithms**: Evaluate new information to determine the fit to the schema and then directs future behavior
Properties of Schemas

- Schemas are developed by prior knowledge and experience
- Individuals:
  - Actively build schemas
  - Revise schemas based on new information
- Information from the environment is perceived depending on prior schemas
- Schemas help people understand, interpret, and remember incoming information
- Facilitates memory because it is easier to remember schema than details
- Culture influences schemas

Review of Information Processing

- **Perception**: Attaching meaning to a stimulus
  - Bottom-Up: Notice separate defining features and assemble them into a recognizable pattern
  - Top-down: Perceive based on the context and the patterns you expect to occur in the situation
Schemas and Information Processing

• Schema Theory proposes an interaction between bottom-up and top-down processing
  – Incoming information activates a schema
    • Bottom-up
      • Facilitates activation and modification of old schema or generation of new schema
    – Once appropriate schema is activated, schema fills in necessary but not explicit details with assumed values
      • Top-down

• If incoming information matches the script, schema is strengthened
• If incoming information does not match the script, search for more accurate schema
• Information that does not fit into any schema likely to:
  – Not be understood or
  – Understood incorrectly
Schemas and Information Processing

- **Information Processing**: Incoming information matches outgoing information
  - Memory matches the environment

- **Schema Theory**: Active attempt to understand information based on prior knowledge and experiences
  - Memories are shaped by prior knowledge and experiences

Functions of Schema

- Enables us to well organize knowledge
- Helps assists in recall
- Guides behavior
- Enable predictions when information is not known
- Make sense of current experiences
Benefits of Schema

• Benefits of connecting new information to schemas (prior knowledge):
  – Better retention of information
  – Better ability to access information in authentic situations

Identifying Students’ Schemas

• Observe students’ behavior and answers
• Ask students to explain their responses or original examples
• Ask students to make predictions about new situations
• Ask students to teach another student
Teaching Strategies

• Connect new information to prior knowledge
  – **Schema Signals**: Indicate the schema that students should use to approach the new information
  – **Advanced Organizer**: Bridge between new information and prior knowledge

• Make instructional materials meaningful
  – **Concept Maps**: Diagram showing the relationship between concepts
  – Identify and correct schemas that are contradictory, wrong, or unnecessary

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Schemata

![Behaviorism Diagram]

- Classical Conditioning: Involuntary behavior
- Operant Conditioning: Voluntary behavior

- **Stimulus**
  - Unconditioned
  - Conditioned

- **Response**
  - Unconditioned
  - Conditioned

- **Reinforcement**
  - Positive
  - Negative

- **Punishment**
  - Positive
  - Negative

Present
Remove
Developing Concept Maps

- Place the main idea in a circle in the center
- List all concepts to include in the concept map
- Group the concepts by higher-order topics
- Place the higher-order topics in circles linked to the main idea
- Link the concepts around the higher-order topic
- Verify the connections on the concept map and change if necessary

Classroom Implications

- Prior knowledge influences what and how a student learns
- What is remembered is largely a function of what was understood to begin with
- Students learn best when they link new information with related existing ideas
  - Information is forgotten unless integrated into existing schemata
- The schemas of students are different from each other and from the teacher
- Both understanding and memory are driven by meaning
Schema Theory Overview

• **Results:** Organized representation of knowledge in memory
• **Means:** Comparison of new information to previously developed schemas
• **Inputs:** Information that fits into previously developed schemas

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Schema Theory Overview

• **Learning Outcomes:** Schema, Organized body of knowledge used to interpret new information
• **Role of the Learner:** Apply previously existing schema to new problems and modify schemas as appropriate
• **Role of the Instructor:** Identify students’ previously developed schema
  – Integrate new information with previously developed schemas
  – Correct inaccurate schemas
• **Inputs for Learning:** Link between new information and previous schemas
• **Process of Learning:** Fitting new information into prior schemas and/or changing the schema