Complex Cognitive Theories

CD 446
C. Knox, Instructor
Complexity

“...transforming and using knowledge skills and ideas.” Woolfolk, p. 269

Interconnectedness of concepts and skills

Metacognition, learning strategies and tactics, problem-solving, creativity, critical thinking, transfer
Taxonomies

- Relationships between types of knowledge and levels of use
- Assist in establishing complex learning objectives
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How People Acquire Concepts

- Concept Attainment models; acquiring complex concepts
- Discovery Learning
- Exposition
- Analogics
- Developmental Models ~ Piaget ~
Some Characteristics

- Strongly linked to instruction in content areas
- Consistent reliance on the concept of “schema” though not always used in exactly the same way
- Ambiguous about the relationship between “mind” and “brain”
Concept Attainment

- Defining attributes, providing prototypes, exemplars and schematic knowledge (Woolfolk, 2010, p. 247-248)
- Relying on compare and contrast skills
- Knowing content well to provide at appropriate level; capture critical points
- Four components of a lesson: examples, attributes, label, definition
Some Issues

- Linking definitions to more general categories already familiar
- Applying the model to how we give explanations
- Building concepts over time, Bruner, spiral curriculum (Woolfolk, 2010, p. 315)
- Checking what learners are attending to
- Prototypes and stereotypes
Structure

Data and concept ID

Testing
- Under generalization and over generalization

Analysis
- Concept mapping
  - Organization charts
  - Webs
  - Creative expressions
Bruner –
Discovery of Structures

Keys to learning
- Understanding foundational structures, principles
- Active engagement
- Inductive reasoning – specific examples are analyzed to reveal a general principle
Designing for discovery

- Intuitive thinking
  - Observation & description
  - Guesses/hypothesis testing
  - Approximations

- Guided discovery
  - Context
  - Liberating constraints
  - Genuinely interesting questions

Sunrise to sunrise? Sunset to sunset? 24 hrs.? So what is a day?
Ausubel – Presentation of Structure

The way in which knowledge is organized is an important part of what is meaningful: expository teaching & meaningful verbal learning

Scope and sequence

Deductive reasoning: applying the principle to the specifics

*The work day is 8 hours*
Designing for Exposition

- Advance organizers; focus key components
  - Comparative or expository
  - Understood by learners
  - Genuinely organizing; clearly express the structure to be exposed
- Compare and contrast, examples
- Relate back to key components
Developmental Context?

Examine the appropriateness of different instructional approaches as related to developmental characteristics

- Is discovery most appropriate for preschool
- Is guided discovery more appropriate for early elementary
- Is expository more appropriate for middle school
- Is analogical appropriate for diverse groups particularly secondary
Problem Solving

- A situation, a goal and a (?) pathway
- Metacognitive training
- General or domain specific

Strategies:
- Algorithms (domain specific)
- Heuristics: means-ends; working backward, analogical
- The world of the self-help manual
Hinder or Help

- Functional fixedness
- Response set
  - Perseverance, bias
- Foreclosure
- Anxiety

- Practice flexibility and fluency
- Play, consider alternatives
- Take time, reflect on strategies
- Support safety, brainstorming
Reflections on a model

- Approach with optimism
- Framing, representation and schema choice
- Schema based vs. search based
- Causal, sequential thinking, solution sets
- Examining the results, luck vs. effort
Experts and Novices

**Expert**
- Memory, patterns and practice
- Procedural knowledge
- Organized and elaborated
- Monitoring skills
- Evaluative criteria

**Novice**
- Intuitive untested perceptions/information
- Misrepresentation of problems/concepts
- Must “unlearn” naïve conceptions
- Tendency not to change what makes “common sense”
Changing Basic Concepts

- Dissatisfaction with current idea
- Understand new concept
- New concept must be plausible in the context of what is known; within range of acceptable explanations/behaviors
- New concept must be useful/helpful in solving interesting problem or creating new satisfying understanding  *adapted from Pintrich, Marx, and Boyle (1993)*
Complex Cognitive Models

- Direct and Discovery Instruction
- Framing what is to be learned and building learning occasions with liberating constraints (*Engaging Minds*)
- Creating occasions that will elicit sophisticated strategies
- “Higher order” thinking and schemas
- Scope and sequence in Curriculum