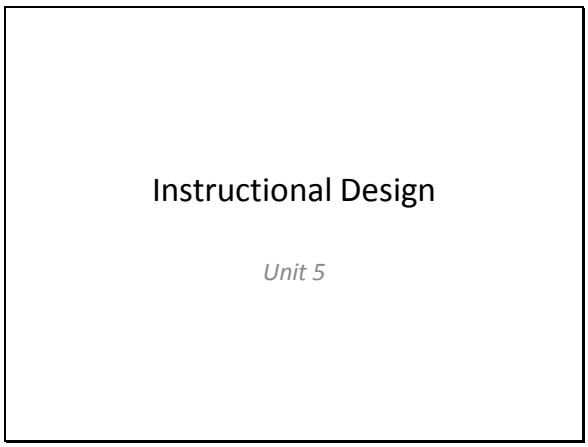
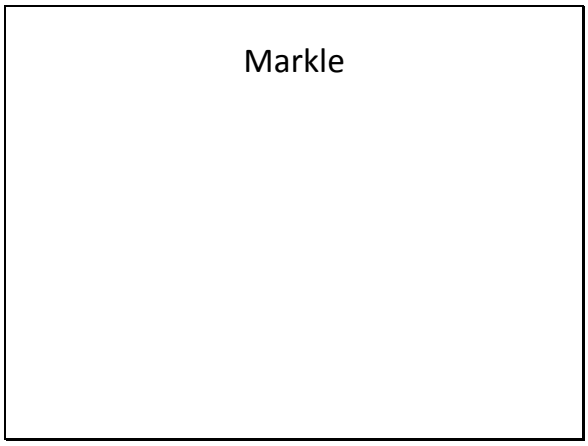
Slide 1



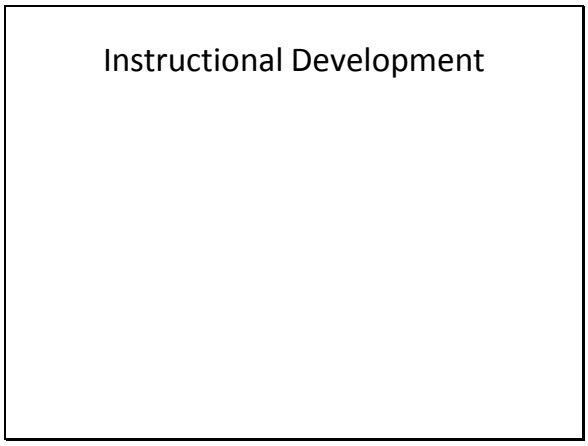

Grades
Readings

Slide 2




Front-end analysis
Differences inherent in learning concepts, verbal skills, and motor skills
Influences on early CBT
Most more interested in hardware / medium than developing improved learning

Slide 3




Traditional educators / naïve ID / looking for magic / don't understand details
Phonics v. whole word / not all phonics / details
Process that creates DI programs, effective teaching machines, fluency aims, etc

Slide 4

Lay out a series of activities

Decision: “We’re done, completed, it will work.” or tryout in class?
If tryout: Teachers report or observe firsthand?
Criteria: Some, most, or all?
If have prereq, then program should work
Learn *everything* teachers teaches

Slide 5

So we test

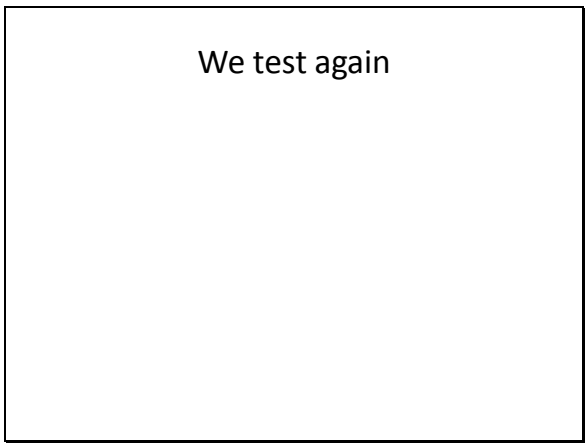
Put our ego on the line. Probably lots of failure
Decision: Bad kids / teachers (but program good) or take responsibility

Slide 6

So we revise

Redo program / interpret errors? / information

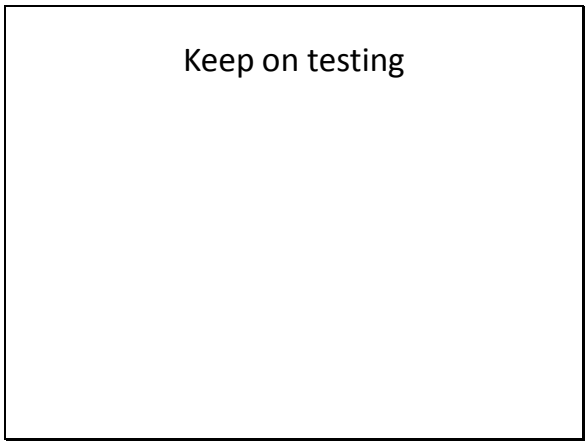
Slide 7




New learners from intended audience
Better, but not flawless

Slide 8


Slide 9




Find even more new learners, may discover even more unexpected errors

Slide 10

Work out all the lumps

Errors are just about always reasonable

Slide 11

Confident program will work

Slide 12

Must be highly specific

Assure teachers don't blow presentation
Exact words

Slide 13

Typical educator reaction

Not “consistent with the way kids learn”
Stifle creativity
Too structured
No understanding of the subject

Slide 14

Typical development sequence

After you initially developed first draft / neither stupid nor arrogant enough
“I’m done. The program is completed and it will work.”

Slide 15

Typical development sequence

But the commercial publisher is.
Vast majority books in schools/ reading, language, arithmetic, science, social studies / no test
Drugs, appliances, gadgets, cars, other consumer items
Production of basals:
-Calculate market / potential share / production costs
-Target audience / physical
-Content criteria
-Wait & see / competitors
-Target date
-Authors chosen last minute / editors / staff members
-Intuitions / no fb
-Continuous re-editing
Ironically / rare children / print no reactions / teachers report
Not responding to what learners like; expressing what they like

Slide 16

Instructional Design of Concepts

Instructors agree intellectual skills and strategies. Mastery of concepts very important, but disagreement on what concept learning is.

Slide 17

## Cognitive Theories

To better teach, must "tune up" the learner's cognition
Instruction is the proving ground of theories. Cognitive theories too broad to suggest specific detail.
Schema theory doesn't provide any specific directions
Sounds like a lot of details and pieces of the puzzle, but still no clear picture on what to do or what concept learning should look like.

Slide 18

## Keller and Schoenfeld

- Strictly speaking, one does not have a concept, just as one does not have extinction – rather, one demonstrates conceptual behavior, by acting in a certain way.
- What type of behavior is it that we call "conceptual"? And the answer is that when a group of objects get the same response, when they form a class the members of which are reacted to similarly, we speak of a concept.

Slide 19

## Environmental Interpretations

Clearer picture of what to do
Way of responding.
Involves multiple "things".
Whether broad: animal
Or narrow: rectangle
Always more than one example
Chicago is not a concept

Slide 20

Generalization and Discrimination Learning

Stimulus classes
Generalization: give same response to new example
Discrimination: react differently to examples and nonexample
Not just academic (recognize good and bad welds before teaching how to weld)

Slide 21

Conceptual Teaching

Mentioning name of concept: not conceptual lesson (apple)
Giving definition: not conceptual lesson (the usually round red or yellow edible fruit of a small tree)
Giving an example: not conceptual lesson (see this apple)

Slide 22

At minimum, to say we taught concept

- More than one example to illustrate concept
- Nonexamples that are almost examples
- Appropriate practice with novel examples and nonexamples

Slide 23

Definitions and dictionaries

Ability to spout memorized definition is not evidence of conceptual understanding (i.e. the response under the control of the full range of stimuli that should evoke the response)
Dictionaries usually fail to pinpoint what controls response.
Dog: "a domesticated canid, *Canis familiaris*, bred in many varieties"

Slide 24

Controlling variables often very difficult to pinpoint

- What defines a human being?
- What stimuli control your verbal response of "human"?

Slide 25

Controlling variables often very difficult to pinpoint

Two arms / two legs / verbal / opposable thumbs / genetic code
Human being: "any individual of the genus *Homo*, especially a member of the species *Homo sapiens*"

Slide 26

Teaching multiple concepts

For simplicity, we'll talk as if concepts are taught one at a time
But, not way we really teach
Dog one day, cat next / "That's a non-dog"

Slide 27

Systematic way of picking examples and nonexamples

Jazz is too far out, even untutored students would reject it

Slide 28

Which pair is best test?

- "Which of these is a rectangle?"

Slide 29

Teaching “dog”:
Which nonexample is really far out?

Slide 30

Teaching “dog”:
Which nonexample is really far out?

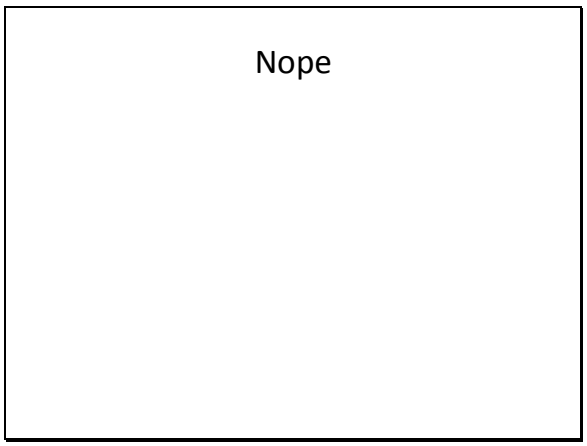
“Far out” is a relative notion

Slide 31

Prototype Approach

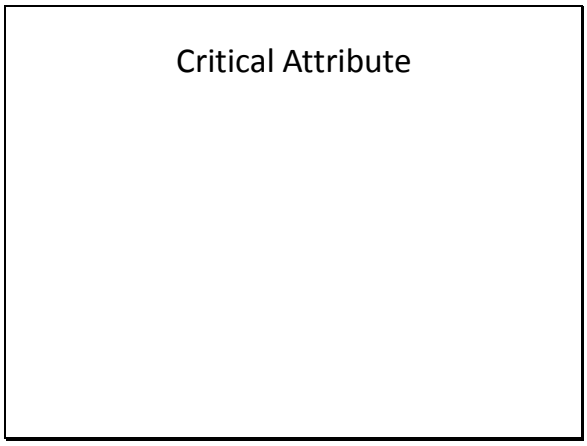
Find a prototype, that is the very essence of your concept.
Discover what is essential to the concept and what is not
Find as many properties as you can and work them over to discover whether or not they are critical

Slide 32



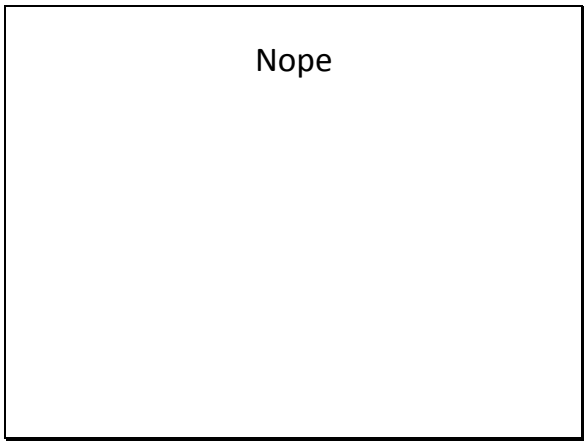

Pinpointed an attribute that is essential to the concept

Slide 33




If changed → nonexample

Slide 34




Yet another critical attribute

Slide 35

Again, not a chair

Slide 36

Must be particular length

Got ourselves a third critical attribute
This critical attribute rarely mentioned in dictionaries

Slide 37

But what about high chairs?

Got ourselves a list of three critical attributes

Slide 38

Examples thus far

Slide 39

Variable attributes

This variable attribute has dimensions or values (five, zero, two)
Others: height of back, material, planes

Slide 40

Salient Properties

Many variable properties, some of which are unimportant
Variable attribution: Location in space when point to it (in dining room, in kitchen)
Arms?
Upholstery?

Slide 41

Nonexamples

Close-in nonexample

Slide 42

Minimum Rational Set of Close-In Nonexamples

Slide 43

Minimum Rational Set of Examples

If any attribute can vary, then it must vary

Slide 44

Minimum Rational Set of Examples

Attributes with fewer dimensions may be reused in any way you want to put the last cases together

Slide 45

Minimum Rational Sets

Note on Minimum Rational Sets (both close-in nonexamples & examples): Is this a set adequate for instruction?

Slide 46

Dimensions of variable attributes

Every possible dimension need not be shown

Slide 47

Assembling Rational Sets

More efficient that just select the examples and nonexamples that come to mind

Slide 48

Debatable Attributes

Not unusual to find lack of agreement as we approach boundary of concept from either side: very unusual example or too-similar nonexample
Human inventions can be especially challenging as new items defy our carefully made criteria
Classify it my way? Let students know about debate? Duck the issue and not mention challenging cases?

Slide 49

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Slide 50

Far-out examples

Far-out example: An example which has a “present” dimension of some variable attribute which, for all other examples, is “absent” or “none”
Variable attributes: “carries a high voltage” or “can transport the sitter”
Again, difficult instructional decision: How far do you go into this topic? May decide that naïve students do not have to become instant experts with full range

Slide 51

Far-out examples

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Slide 52

Divergent Examples

Two examples (have all critical attributes)
No variable attributes in common

Slide 53

## Matched Nonexamples

1 example, 1 close-in nonexample
Variable attributes match completely
All critical attributes but one match

Slide 54

## When testing:

- Generalization: Correctly identify example
  - Call Fuji apple an "apple"
- Discrimination: Correctly reject nonexample
  - Call pomegranate a "non-apple"

Slide 55

## Testing Concept: Book

- Taught with:
- Best test for discrimination?

"Which of these is a book?"
Magazine: discrimination
Ashtray: far-out nonexample
Dictionary: Generalization
Sunday paper: Rote
We want two kinds of evidence when testing concepts: 1) correct identification of new examples and 2) correct rejection of new nonexamples
In concept learning, good nonexamples are close to true examples. True test of conceptual mastery must present new situations not included in instruction.

Slide 56

## Testing Concept: Insect

- Taught with:
  - Test item:
- Generalization? Discrimination? Rote memory?

Slide 57

## Errors during testing

- Overgeneralization: Incorrectly accept nonexample
  - Calling scorpion an "insect"
- Undergeneralization: Incorrectly reject example
  - Calling bee a "non-insect"

Slide 58

## Concept: Car

- Generalization, discrimination, overgeneralization, or undergeneralization?

Learner response:
"Car"

Slide 59

## Concept: Car

- Generalization, discrimination, overgeneralization, or undergeneralization?

Learner response:
"Car"

Slide 60

## Concept: Car

- Generalization, discrimination, overgeneralization, or undergeneralization?

Learner response:
"Not car"

Slide 61

## Concept: Car

- Generalization, discrimination, overgeneralization, or undergeneralization?

Learner response:
"Not car"

Slide 62

If learners are overgeneralizing

Add more close-in nonexamples to instruction

Slide 63

If just use examples on hand

If teaching “dog” using an unplanned sequence of neighborhood dogs

Slide 64

Not surprising if undergeneralize when extreme case appears

Solution: Increase range of examples used during teaching, looking for salient variable attributes you may have neglect

Slide 65

Concept: Reinforcer

Teach with only lab examples (hungry animals), may fail to generalize

Slide 66

Lean Programming

May get impression to add as many examples and nonexamples as possible
Not good idea (despite Principle of Small Steps): Frustration at pace, tedious for all but the slowest learner
Lean programmers / very tough lessons / errors pinpoint assumption
Principle 1: Do not include instruction on any prerequisite knowledge or skill that learner could possibly already know
Principle 2: Include only the minimum amount of practice

Slide 67

THE END

Next week: Spring break
March 10th: Study session with Megan: 5:30-6:30
March 11th: Unit 5 exam
March 13th: Online tutorial only, 5 pts for completion
March 18th: Normal lecture