

EDS-544

Week 2: Concepts on theory and
theories of instruction

Dr. Evrim Baran

Middle East Technical University

“I view science not as a search for imperishable truth but more as a kind of game, a game we play partly for the fun of it, but partly also because it will increase our understanding.”

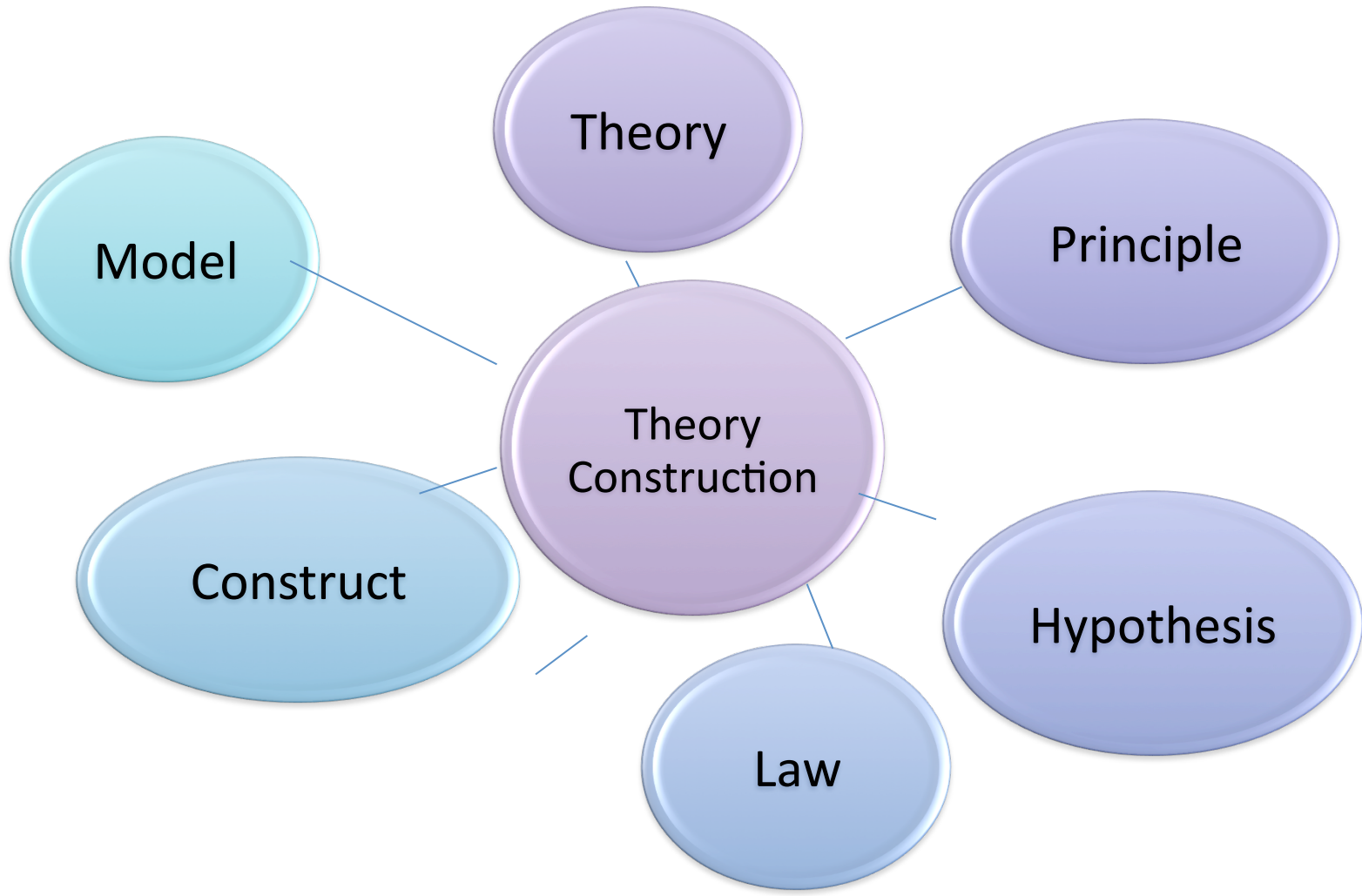
Bolles, 1967

Both psychology and education use **scientific method** to develop their theories instead of instinct or personal experience

Four general and overlapping categories of the problems of science:

1. To accumulate accurate data,
2. To utilize correct methodology,
3. To formulate valid theory,
4. To make proper inferences.





What is theory?

- Theoria, “ a looking at, viewing, beholding”
- “A set of propositions that are **syntactically integrated** (that is, that **follow certain rules** by which they can be **logically related to one another** and to some observable data base) and which serve as a means of **predicting** and **explaining** observable phenomena

Motivational theory, Chaos theory, Number theory, Game theory, Theory of income, Theory of relativity

String Theory



Theory Development vs. Fact Gathering

- Why **theory** rather than **fact**
 - Preparation of theory is not only important but also vital if either discipline is to progress and to make a contribution toward solving the problems, considered to be in their domain.
- Most of the improvements in science have occurred due to the men's willing to organize their ideas in the form of theories and to let other men evaluate them

What is hypothesis?

- “A statement about a **suspected relationship** between variables” (e.g. correlative, casual) (p. 32).
 - All theoretical statements are by definition hypotheses in the sense that scientist accept them as tentative statements in the unending search for more accurate explanations of the subject matter.

CORRELATIVE: A variation in x will be systematically related to a change in y.

CASUAL: A manipulation of x causes a change in y.

What Type of Hypotheses? What are Independent and Dependent Variables in the following Hypotheses?

- ...science achievement differs with regard to father's education
- ...weight training reduces injuries in elderly women
- ... There is a significant difference between students' achievement scores on science and math by gender (female, male)
- ... There is no interaction between gender and note-taking method. (*The effect of note-taking method does not depend on the levels of the gender*)

What Type of Hypotheses? What are Independent and Dependent Variables in the following Hypotheses?

(Dependent Independent)

- ...science achievement differs with regard to father's education level *casual*
- ...weight training reduces injuries in elderly women *correlative*
- ... There is a significant difference between students' achievement scores on science and math by gender (female, male) *casual*
- ... There is an interaction between gender and note-taking method. (The effect of note-taking method does not depend on the levels of the gender) *casual*

Theory vs. Hypothesis

- All theories are hypothesis.
- Not all hypothesis are derived from theories
- While theories are organized system of propositions hypothesis are not.
- Theories are broad conceptual explanations while hypotheses are short and specific statements which guide scientists in making their observations.

Theory & Hypothesis



Global Warming

There is relationship between CO₂ concentration and the temperature

Scientists:

collect data from atmosphere

Study the CO₂ concentration in Antarctica to obtain data from previous ice ages

The Big Bang Theory - If scientific theories were like religions

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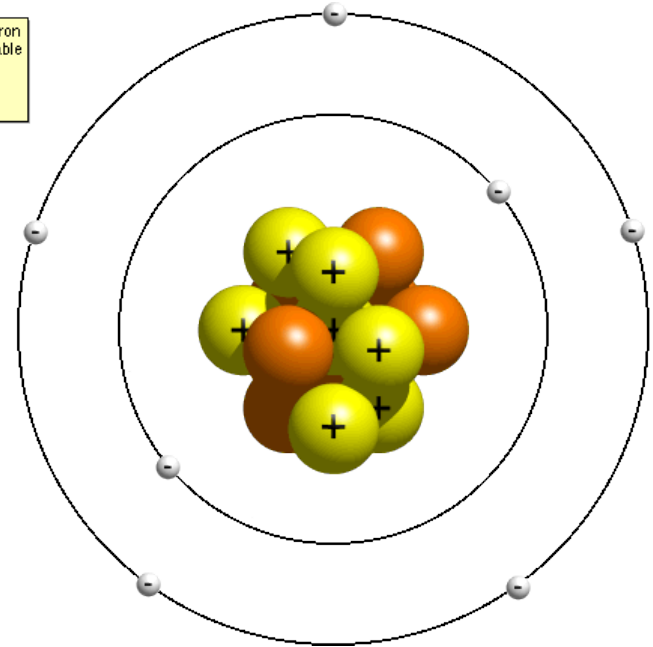
http://www.youtube.com/watch?v=n_wkCUxOuiM

What is model?

- “**Concretization** of a theory which is meant to be analogous to or **representative** of the processes and variables involved in the theory” (e.g. physical models, computer models, mathematical models)

Nitrogen's Electron Configuration Table
 $1s^2$
 $2s^2 2p^3$

E.g. Dick&Carey ID Model, ADDIE Model, Systems Design Model,



Theory vs. Model

- A **theory** provides a general explanation for observations made over time
- A **model** is a mental picture that helps us understand something we cannot see or experience directly

What is law? & What is principle?

- Law: “Statement about a relationship between variables whose probability of occurrence is so **high** that the relationship can be counted on as being highly dependable” (p. 34)
- Principle: “A statement of relationships which has allegedly had some empirical support but which either is not obviously fundamental or is **not sufficiently well established** to be called a law” (p. 34)

What is law?

- Bergmann's law

House sparrows in Alaska are larger and stronger compared to house sparrows in Los Angeles. (Description)



- The Theory of Evolution

Sparrows adapted to colder environments through natural selection for larger bodies. (Explanation)

What is construct?

- “An entity whose existence and properties cannot directly or automatically be empirically deduced and which, therefore, can only be described on the **basis of a network of converging operations**” (p. 35) (e.g. intelligence)

Fill in the blanks

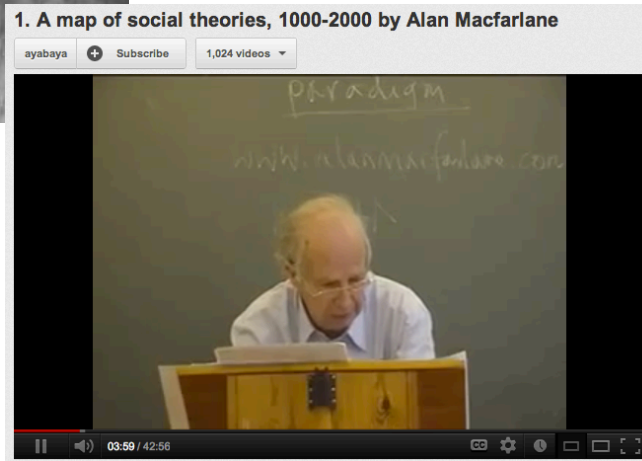
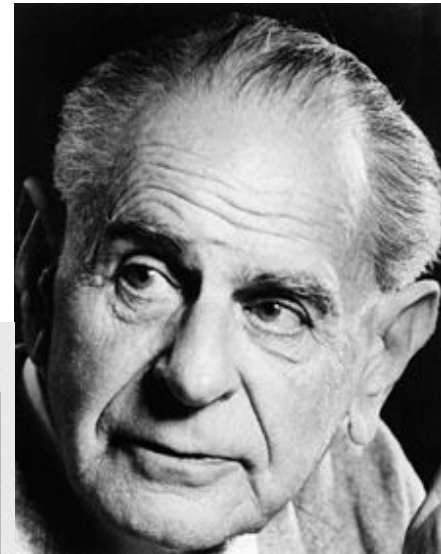
- A ----- contains various ----- and generate -----, ----- are most often intended to translate a -----into some other form from the one which it was originally invented. ----- and ----- are often used as he building blocks with which ----- are made.

Fill in the blanks

- A **theory** contains various **constructs** and generate hypotheses. **Models** are most often intended to translate a **theory** into some other form from the one which it was originally invented. **Laws** and **principles** are often used as the building blocks with which **theories** are made.

Further Reading/Watching

Thomas Kuhn, Paradigms Karl Popper, Falsification



<http://www.youtube.com/watch?v=Tf9QJ02VkhU&feature=fvst>

Functions of theories

- **Systematize Findings**

Arrange research findings, decrease complexity

- **Generate Hypothesis**

Provides a base for hypothesis

Hypothesis is constructed over theories

- **Make Predictions**

Scientists can guess the result of an experiment

- **Provide explanation**

Theory answers the question “Why?”

*Why do certain events occur?

*Why does the manipulation of one particular variable produce a change in another?

The Big Bang theory - Sheldon's superman theory

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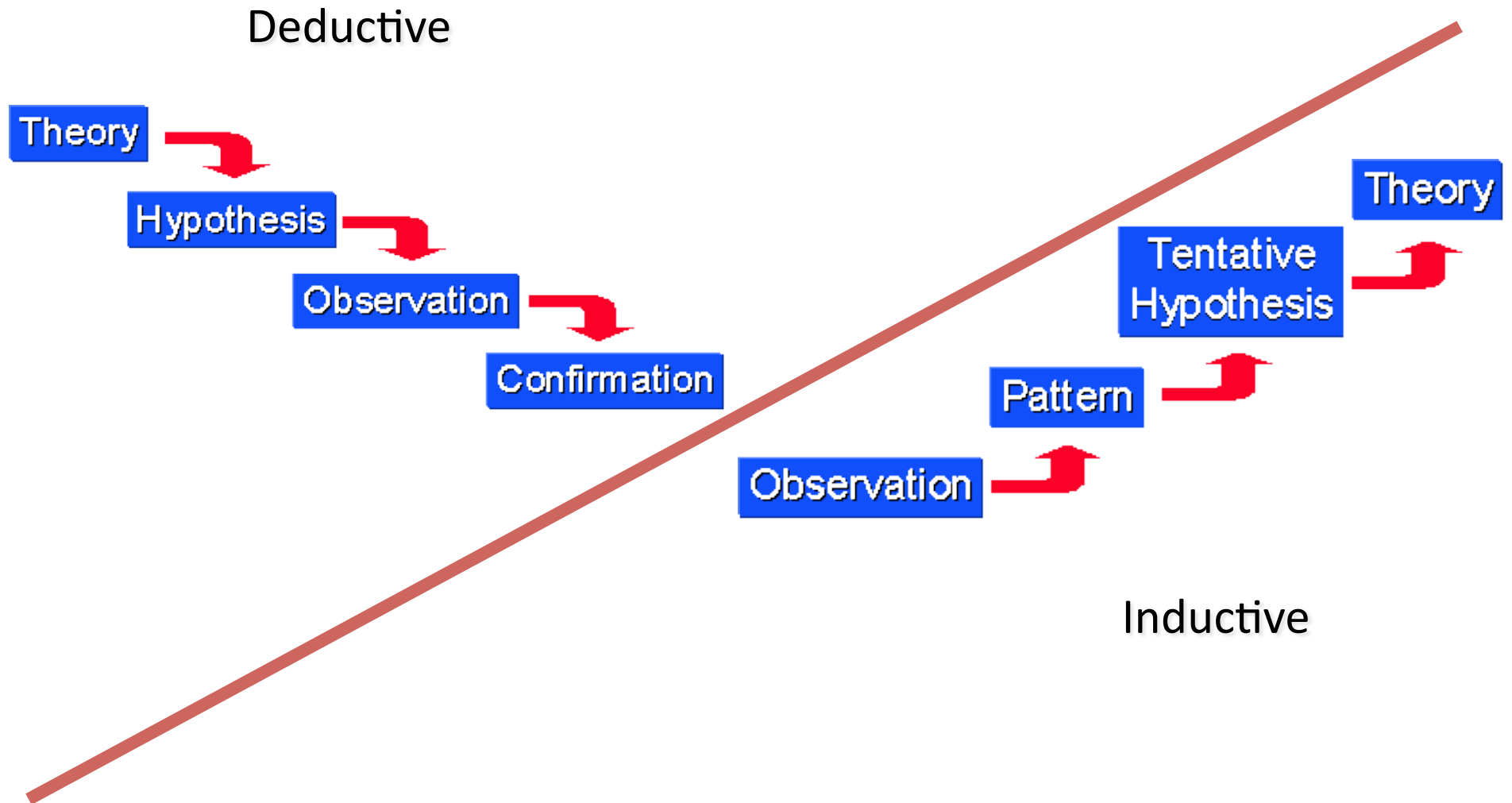


1:27 / 1:40



<http://www.youtube.com/watch?v=-PvwtS0htyk>

The construction of theories



The construction of theories

Scientific Method	Making Spaghetti Sauce
Observation	Spaghetti sauce should be red.
Hypothesis (prediction)	Maybe try a tomato sauce.
Test	Heat pot of tomato sauce.
Observe result	Taste the sauce - bland.
Revise hypothesis?	Use tomato sauce and garlic!
New test?	Add garlic, taste - not so bland.
Scientific Theory	The Final Recipe.

“A good theory is one that holds together long enough to get you to better theory” (Hebb, 1969, p. 27)

Scientific theories

- Psychology and education
 - Is it science?
 - Do we then need theory of education?
 - Are they practitioner oriented disciplines?
- Science:
 - Accumulate accurate data
 - Utilize correct methodology
 - Formulate valid theory
 - Make proper inferences

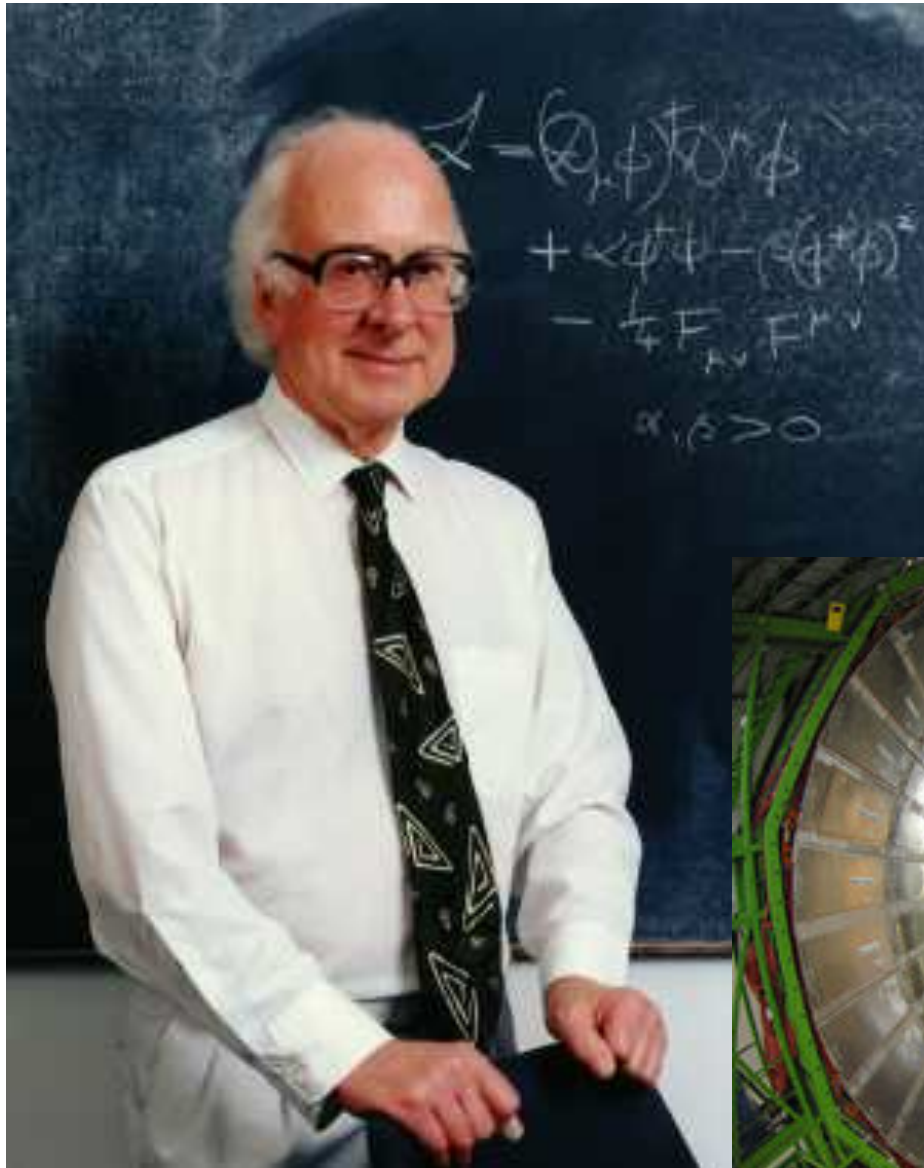
The need for theory

“Great advances in science have come about because men have been willing to organize their ideas in the form of theories and to let other men evaluate them. Old theories create new theories, and new theories create experiments, and experiments create increased knowledge and understanding” (p. 27)



Are you sure there is not another way to prove Skinner's theory??



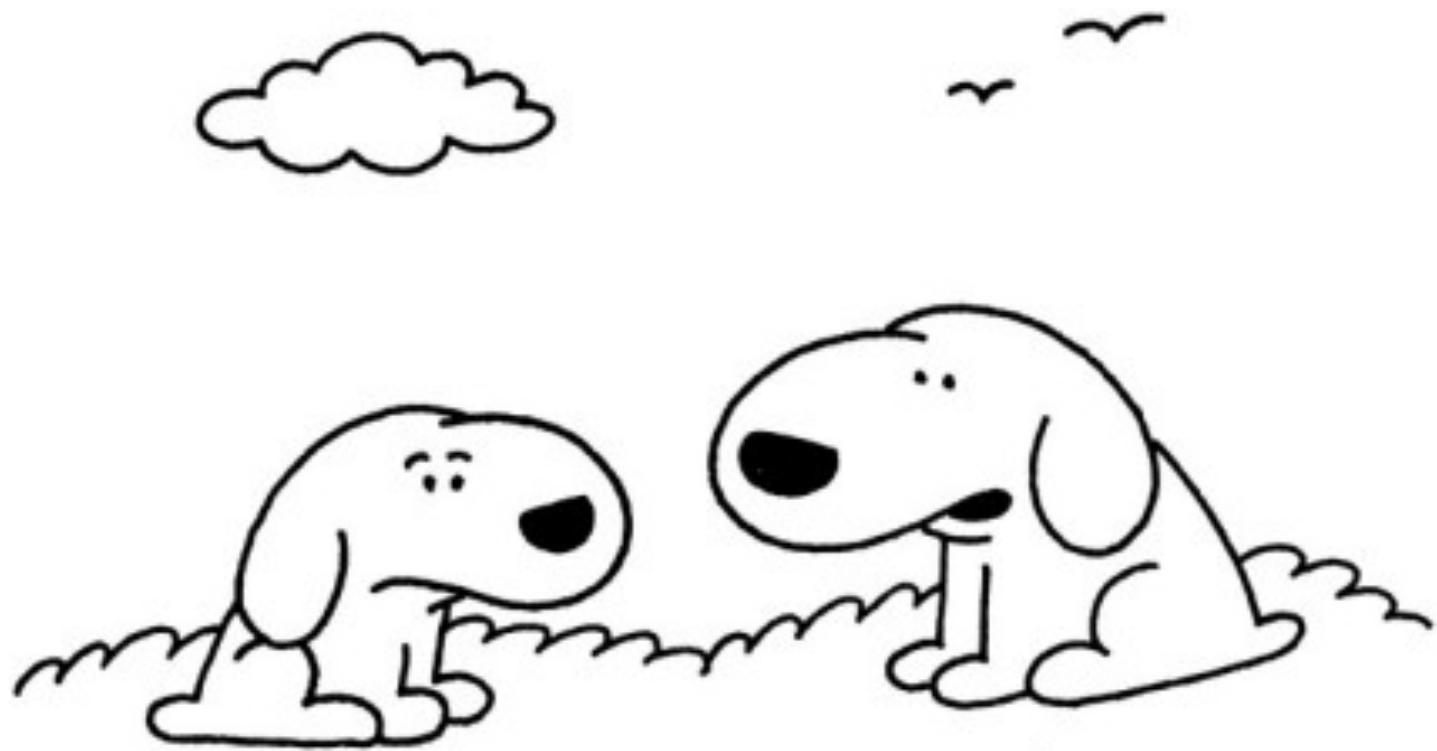


- “No theory is absolute or so all-inclusive that it can be completely verified by the most extensive of scientific investigations” (p. 28)

EVER TRIED.
EVER FAILED.
NO MATTER.

TRY AGAIN.
FAIL AGAIN.
FAIL BETTER.

-SAMUEL BECKETT



C. Barvotti

"It's just a theory, but perhaps it's their opposable thumbs that makes them crazy."

Jerome Bruner

- http://www.youtube.com/watch?v=r2H_swMUIOg



Timeline?

- 1963: Bruner's four criteria for the theory of instruction at the ASCD (The Association for Supervision and Curriculum Development) 1963 annual conference
- 1964: 9th Curriculum Research Institute proceedings on the theories of instruction
- 1968, position paper, Ira Gordon's criteria for theories of instruction
- 1974, Cawelti writing in Educational Leadership: Eight component areas for educators
- 1971, Bugelski
- 1974, Snelbecker
- 1973, 1975, Hosford, explicit definitions of instruction and teaching

Prescriptive

- The most effective procedures for achieving a given goal, and provides a yardstick against which any instructional procedure may be evaluated.

Theories of Learning and Theories of Instruction

- Congruent with those theories of learning and development to which it subscribes.
- Theories of learning: Descriptive
 - E.g. Most children of six do not possess the notion of reversibility
- Theories of instruction: Prescriptive (improving rather than describing learning)
 - E.g. what is the best means of leading the child toward the notion of reversibility.

1. Specify experiences

- Specify experiences that will tend to make the learner willing and able to master the curriculum.
 - What sorts of relationships with people and things in the preschool environment will tend to make the child willing and able to learn when he enters the school?



2. Specify the structuring of knowledge

- Specify the ways in which a body of knowledge should be structured so that it can be most readily grasped by the learner.
- Example from the fields.

3. Specify the most effective sequences

- Sequences to present the materials to be learned.

4. Specify nature and pacing of reinforcements

- Nature and pacing of rewards and punishments in the process of learning and teaching.
 - Extrinsic/intrinsic rewards
 - Immediate/deferred rewards
 - Timing

Ira Gordon's Criteria for Theory of Instruction

- Include a set of postulates and definition of terms involved in these postulates;
- Make explicit the boundaries of its concern and the limitations under which it is proposed;
- Have internal consistency;
- Be congruent with empirical data;
- Be capable of generating hypotheses;
- Contain generalizations that go beyond the data;
- Be verifiable;
- Be stated in such a way that it is possible to collect data to disprove it;
- Not only explain past events, but predict future events; and
- Represent qualitative synthesis

Cawelti (1974) Eight component areas for educators

- Human growth and development
- Motivation
- Organization
- Concept choice and sequence
- Material selection
- Learning strategies
- Learning theory
- Environment

Psychology of learning and instruction (Marcy Driscoll)

- A learning theory explains the results associated with learning and predict the conditions under which learning will occur again.
- It is the goal of instruction to apply this knowledge in the provision of appropriate conditions for facilitating effective learning.

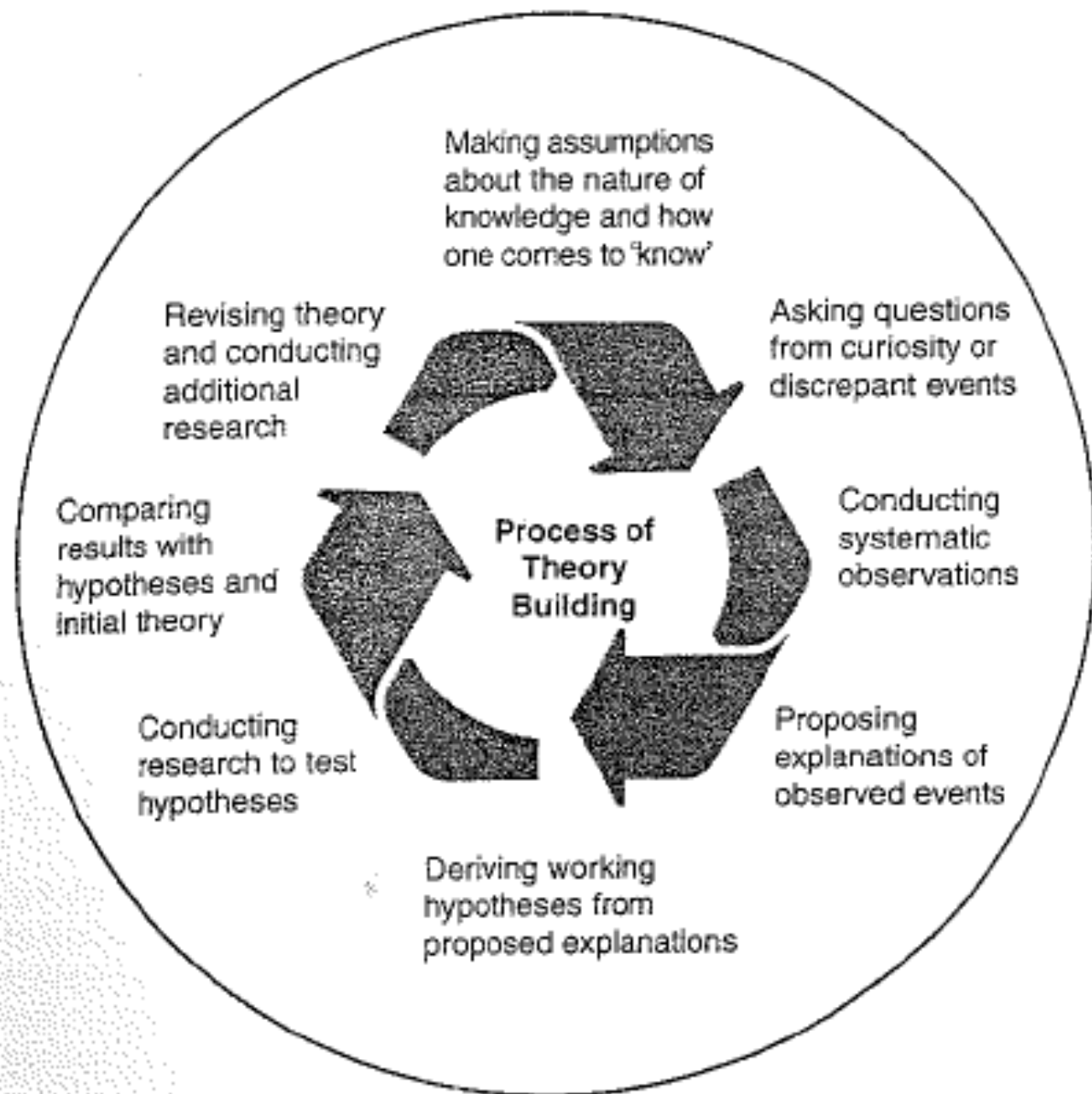


FIGURE 1.1 *A Systematic and Recursive Process for Building a Theory*

The epistemology of learning

- What is valid source of knowledge?

Empiricism, rationalism, nativism

- Does knowledge come from experience?
- Does it come from thinking and reasoning about things?
- Is some knowledge already present at birth and therefore inherited?

The epistemology of learning

- What is the content of knowledge?

Skepticism, realism, idealism, pragmatism

- Is it possible to know the world at all?
- Can all phenomena be known?
- Does knowledge consist of ideas constructed about reality?

The epistemology of learning

- Epistemological orientations and traditions

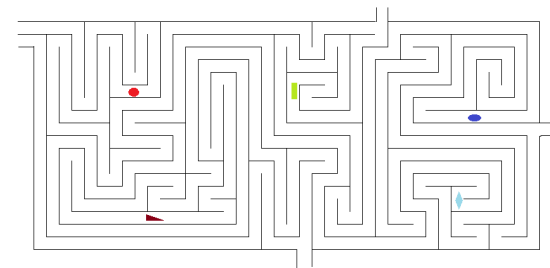
Objectivism, pragmatism, interpretivism

	<i>Objectivism</i>	<i>Pragmatism</i>	<i>Interpretivism</i>
<i>Assumptions about reality</i>	Reality is objective, singular, fragmentable	Reality is interpreted, negotiated, consensual	Reality is constructed, multiple, holistic
<i>Nature of truth statements</i>	Generalization, laws, focus on similarities	Working hypotheses, focus on similarities or differences	Working hypotheses, focus on differences
<i>Source(s) of knowledge</i>	Experience	Experience and reason	Reason
<i>Types of research designs</i>	Experimental, a priori	Any design may be useful for illuminating different aspects of reality	Naturalistic, emergent
<i>Associated learning and instructional theories</i>	Behaviorism, cognitive information processing, Gagné's instructional theory	Educational semiotics, Bruner's and Vygotsky's views of learning and development	Piaget's developmental theory, constructivism

What is your personal epistemology?

Unger et al. (1986), Attitudes about reality scale

Visual Metaphors



Questions from the Class

- Erdem: A question: I wonder what is the level of this "persisting change". How can we measure it? How many years should pass that a remembered knowledge can be regarded as "it was learnt". What does it mean to say "persisting change"? 1 day? 1 year? Throughout the life?

Questions from the Class

- Bilge: I have still some question marks on settling down the understanding of "construct" (Snelbecker) word in the frame of psychological aspects.

Questions from the Class

- Gamze: In educational research how much research is needed to conclude that a method/technique/approach/theory is ineffective or effective? How do we know where to stop using that particular theory? I wonder if it is possible to establish a standard in educational research to conclude that "all of the previous research justify that Method X is ineffective in learning, so we should stop using it".
- We know that teachers' epistemological beliefs shape their instructional methods; as teacher educators what can we do if a pre-service teachers' epistemological beliefs lead him/her to use ineffective instructional processes? Should we try to change their beliefs or should we try to break the relationship between epistemological beliefs and their instructional decisions or should we do nothing?

Questions from the Class

- Hatice: I am wondering that can the combination of theory construction ways be used on instruction theory? Had not any theoretician realised that it is the best way of mixture instead of developing the new one?