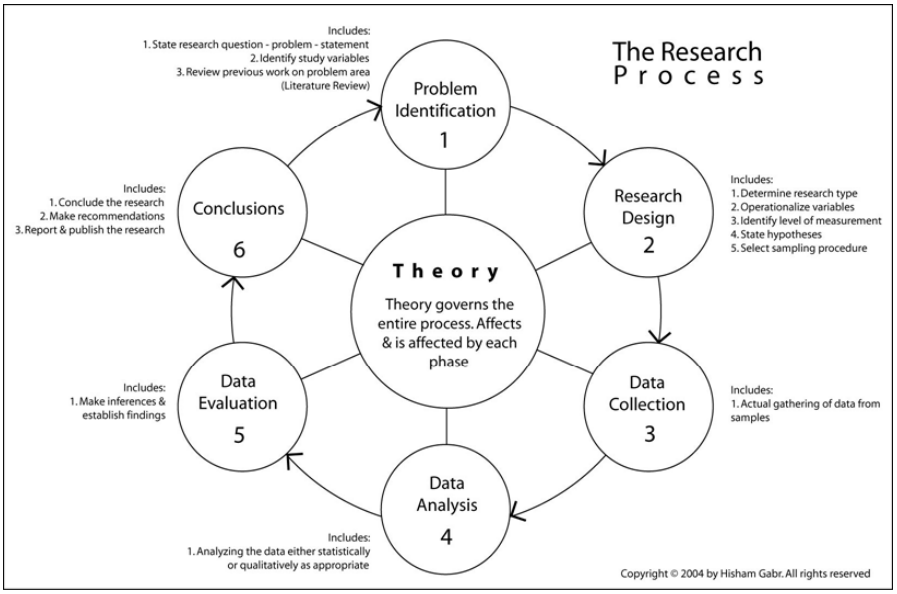
Experiments

The Research Process خطوات البحث العلمي



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The Logic of Conducting Experiments

Experiments offer the best known scientific way to establish causality or causal relationship between variables.

Three conditions have to be met for proving that and event A (presumed cause) actually causes event B (presumed effect):

The Logic of Conducting Experiments

Conditions for causal relationship between cause & effect variables (e.g.. A causes B)

1. Co-occurrence (co-variation)

Both A and B must be observable and measurable, and that some sort of relationship exists between the cause and the effect (if A then B, if not A then not B)

2. Sequence (temporal precedence)

Cause must come first then the effect second (A precedes B)

3. Elimination of alternative explanations

Eliminate other possible or plausible causes
Alternative hypotheses are tested

Variables

Independent V.	Dependent V.
Manipulated by the experimenter	Outcome of the manipulation
Cause	Effect
Experimental V.	Outcome V.
Predictor V.	Response V.
Manipulated V.	Criterion V.

Notations of Experiments

O = observation (measurement of dependent variable - effect)

T = treatment or experimental stimulus (introduction of independent variable - cause)

Experiments (The Simple Experiment)

	IND. V. Treatment	
	D. V. Observation 1	D. V. Observation 2
Experimenter Group	O	T O
Control Group	O	O
	Pretest	Posttest

Experiments: The one-shot case study

No pretest: what is the problem ?

	Treatment	Observation
Experimenter Group	T	O

No original observation to compare O with; how could one say O changed ? Misleading results

Experiments: One-group pretest-posttest design

With pretest, no control group: what is the problem ?

	Observation 1	Treatment	Observation 2
Experimenter Group	O	T	O

Perhaps extraneous variables played a role in altering O2; i.e. change in O2 is not necessarily a result of the treatment (IN.V.)

Experiments: Static Group Comparison

Static Group Comparison (2 groups but no pretest): what is the problem ?

	Treatment	Observation
Experimenter Group	T	O
Control Group		O

Initial status of groups unknown; i.e. how can one make sure both groups are equivalent ?

Experiments (The Simple Experiment)

	Observation 1	Treatment	Observation 2
Experimenter Group	O	T	O
Control Group	O		O
	Pretest		Posttest

Variables

Extraneous V.

Is any variable that may have an influence on the effect of the experimental manipulation

One needs to control the effects of the Extraneous V.

Variables

Controlling the Extraneous Variables:

1. Eliminate or hold extraneous variables constant
2. Measure the extraneous variables to take them into account in the analysis
3. Use a control group or control conditions

Experiments (The Simple Experiment)

	Observation 1	Treatment	Observation 2
Experimenter Group	O	T	O
Control Group	O		O
	Pretest		Posttest

Random Assignment

Assigning subjects in random to both experimental and control groups to ensure equivalency of both groups in terms of the dependent variable

Random assignment is different from random selection (in sampling)

Experiments (The Simple Experiment)

	Treatment	
	Observation 1	Observation 2
Experimenter Group	T	O
Control Group		O

Posttest Only

Pretest can be cancelled only if the 2 groups are guaranteed to be equivalent by random assignment

True Experiment

Conditions for a true experiment

1. Random assignment is possible
2. Control over extraneous variables is possible

Components of the Basic Experiment

1. Independent and dependent variables
2. Pretesting and posttesting
3. Experimental and control groups

Experimental Designs

Between-Subject Design

Randomly assign a group of subjects to one condition and another group of subjects to the other condition

Within-Subject Design

Assign the same group of subjects for both conditions of the experiment

Hawthorne Effect

Possible effect of the experiment itself rather than of the experimental treatment

Need control group or Placebo (e.g. sugar pill in medical research)

Experimental Variations

1. One group pretest-posttest
2. Control group pretest-posttest (two group)
3. Randomized Solomon four-group design
4. Randomized control-group posttest only
5. Nonrandomized control-group pretest-posttest
6. Counterbalanced treatments
7. One-group time-series
8. Control-group time-series

Quasi-Experiments

Lacks one of the critical components of the true experiment

Either

Random Assignment is not possible; i.e. non equivalent groups

Or

Lack of control over extraneous variables

Threats to Validity

Internal Validity

The extent to which changes in the dependent variable can be attributed to the independent variable, rather to an extraneous variable; Degree to which a procedure measures what it is supposed to measure

External Validity

The extent to which we can generalize the results of a research study to people, settings, times, measures, & characteristics other than those used in the study

Threats to Internal Validity

1. History (effect of historical outside event)
2. Maturation (subjects growing older, tired, hungry, etc.)
3. Testing (Pretesting or posttesting influencing behavior)
4. Instrumentation (measurement instrument between pretest & posttest, comparable)
5. Statistical regression (extreme measures of dependent variable)
6. Selection biases (equivalent, comparable groups)

Threats to Internal Validity

7. Experimental mortality (subjects dropping off)
8. Causal time-order (did stimulus cause dependent v. or dependent v. caused changes in stimulus; rare)
9. Diffusion or imitation of treatments (passing info from experimental group to control group)
10. Compensation (effect of compensation on control group)
11. Compensatory rivalry (deprived control group try to beat special experimental group)
12. Demoralization (deprived control group give up)

Threats to External Validity

1. Interaction between the testing situation & the experimental stimulus (testing interaction with the stimulus) – groups took pretest in experiment, groups will not take pretest in real life.