

EXPERIMENTAL RESEARCH

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- A type of research aimed at establishing the possible cause and effect relationship between variables under study through some systematic and well planned observations carried out in controlled conditions.

Conducting an experimental research

- select the problem that is answerable with available tool
- Formulate a hypothesis as a tentative solution to the problem
- select participants and instrument
- selection and execution of a research design/plan
- collection and organization of data
- Conclusions and generalization of hypothesis if it is confirmed

PRINCIPLES OF EXPERIMENTAL DESIGNS- R. A. FISHER

- PRINCIPLE OF REPLICATION-each treatment is applied in many experimental units/experiment should be repeated more than once for accurate results.(replication itself is a source of variation)
- PRINCIPLE OF RANDOMIZATION-provide protection against the effect of extraneous factors by randomization(chance error)

- PRINCIPLE OF LOCAL CONTROL-we can eliminate the variability due to extraneous factors from the experimental error.(under it the extraneous factor, the known source of variability is made to vary deliberately. This needs to be done in such a way that variability it causes can be measured and hence can be eliminated from the experimental error.)

EARLY EXPERIMENTATION

- LAW OF SINGLE VARIABLE-(Jon Stuart Mill- 1873)-
If two situations are alike in every respect, and one element is added to one but not the other, any difference that develops is the effect of the added element, or if one element is removed from one but not from the other, any difference that develops may be attributed to that element.

VARIABLES

- a concept (e.g., intelligence, height, aptitude) that can assume any one of a range of values
- **INDEPENDENT**- an activity of characteristic believed to make a difference with respect to some behavior
(syn.) experimental variable, active variable, cause, treatment
- Treatment variable-manipulated eg. Duration of treatment
- Attribute variable-can not be altered eg. Age, sex, race etc.

DEPENDENT VARIABLE

- the change or difference occurring as a result of the independent variable
(syn.) criterion variable, assigned variable, effect, outcome, posttest
eg.- academic achievement, language development, social skills, emotions, adjustment etc.

CONTD.....

- **CONFOUNDING VARIABLE**- the fact that the effects of the independent variable may intertwine with extraneous variables, such that it is difficult to determine the unique effects of each variable
- ... (syn.) criterion variable, assigned variable, effect, outcome, posttest
- **INTERVENING**- anxiety, fatigue, motivation etc. can be controlled through appropriate design
- **EXTRANEIOUS**- SES, age, competency etc. can be controlled through proper selection of sample.

CONTRLLING EXTRANEIOUS VARIABLES

- Removing the variable
- Matching cases
- Balancing cases
- Randomization
- Analysis of covariance

EXPERIMENTAL VALIDITY

- **INTERNAL VALIDITY**- to the extent that the factors that have been manipulated, actually have a genuine effect on the observed consequences.
- **EXTERNAL VALIDITY**-to the extent to which the variable relationship can be generalized to other settings.

THREATS TO INTERNAL VALIDITY

- MATURATION
- HISTORY
- TESTING
- UNSTABLE INSTRUMENTATION
- STATISTICAL REGRESSION (regression to the mean)
- SELECTION BIAS
- EXPERIMENTAL MORTALITY
- EXPERIMENTER BIAS (blind/double blind)

THREATS TO EXTERNAL VALIDITY

- INTERFERENCE OF PRIOR TREATMENT
- ARTIFICIALITY OF EXPERIMENTAL SETTING
- INTERACTION EFFECT OF TESTING
- INTERACTION OF SELECTION AND TREATMENT(selected sample rarely random)
- THE EXTENT OF TREATMENT VERIFICATION (Someone else delivers the treatment)

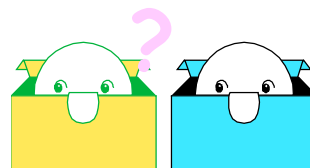
Types of reactive arrangements...

- ...**Hawthorne effect (1933)**: any situation in which participants' behavior is affected not by the treatment per se but by their knowledge of participating in a study
- ...**compensatory rivalry**: the control group is informed that they will be the control group for a new, experimental study ("**John Henry effect**")

...**placebo effect**: the situation in which half of the participants receive no treatment but believe they are

...**novelty effect**: the situation in which participant interest, motivation, or engagement increases simply because they are doing something different

Questions or Comments



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THANK YOU

EXPERIMENTAL DESIGNS

- **PRE-EXPERIMENTAL**-least effective, it provides either no control group or no way to equate the groups
- **TRUE EXPERIMENTAL**- employs randomization to provide for control of the equivalence of groups and exposure to treatment
- **QUASI EXPERIMENTAL**- provides a less satisfactory degree of control. Used only when randomization is not feasible.

ANOTHER CLASSIFICATION

- **INFORMAL DESIGNS-** (less control)
 - before and after without control
 - after only with control
 - before and after with control
- **FORMAL DESIGNS-** (more control)
 - Latin square design
 - factorial design
 - randomized block design

CLASSIFICATION CONTD.....

Single Factor Designs

- Pretest-posttest (one-group)
- Pretest-posttest (control group)
- Posttest-only (control group)

Multiple Factor Designs

- Two-way factorial
 - e.g., 2 x 3
- Three-way factorial
 - e.g., 2 x 2 x 3

PRE EXPERIMENTAL/INFORMAL

one-shot case study

X O

a single group exposed to a treatment (X) and then post tested (O)

one-group pretest-posttest design

O X O

a single group is pretested (O), exposed to a treatment (X) and, then, is posttested (O)

PRE-EXPERIMENTAL(CONTD.)

static group comparison X_1 O X_2 O

- involves at least two groups (X), one receiving a new, or experimental treatment (X_1) and another receiving a traditional, or control treatment (X_2) and, then, are post tested (O)

TRUE EXPERIMENTAL DESIGNS/FORMAL

- Post test only, equivalent group design-

R X O1

R C O2

Treatment effect = $O1 - O2$

Pre test- post test equivalent group design-

R O1 X O2

R O3 C O4

Treatment effect = $O2 - O1 = A$

 $O4 - O3 = B$

TE = A - B

- **The Solomon four group design-**

Ra O1 X O2

Rb O3 C O4

Rc X O5

Rd C O6

Combination of above two designs

Comparison of (Ra and Rc) and (Rb and Rd)

Possible to evaluate the effect of testing, history and maturation etc.

Difficulty in finding enough subjects to assign randomly to four equivalent groups

QUASI-EXPERIMENTAL DESIGNS

- Pre test post test non equivalent groups design-
 - O1 X O2 A = O2 - O1
 - O3 C O4 B = O4 - O3
 - Treatment effect = B - A
- random assignment of intact groups that are pretested (O), exposed to a treatment (X) and then posttested (O)
- Groups can be two classes or two slums etc.

counterbalanced design

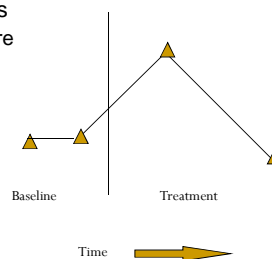
- X₁ O X₂ O X₃ O
- X₃ O X₁ O X₂ O
- X₂ O X₃ O X₁ O
- all of the groups receive all treatments but in a different order; the number of groups and treatments must be equal

TIME SERIES DESIGN

- O O O O O X O O O O O
- a single group is pretested (O) repeatedly until pretest scores are stable, exposed to a treatment (X) and, then, is repeatedly post tested (O)
- Control group time series
 - O O O O O X O O O O O
 - O O O O O C O O O O O

Single Subject Design

- Time series analysis
 - Dependent measure is continuous
 - Establish baseline
 - Measure treatment effect over time



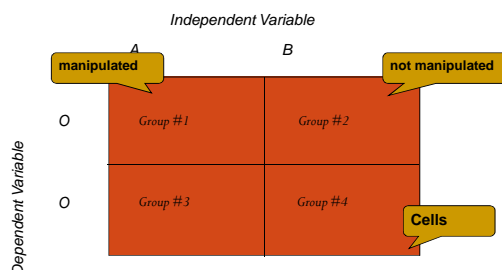
Two-Way Factorial Design

- Studies multiple independent variables-eg.sex and teaching method
- Main effects (ME)
- Each with a number of levels (L)
- Permits study of interactions
- Analysis
 - ANOVA

Example: 2 x 3

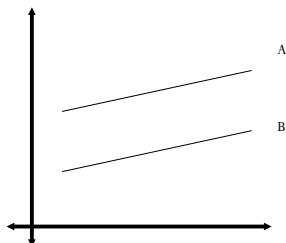
		ME2		
		L1	L2	L3
ME1	L1			
	L2			

A 2 X 2 factorial design...



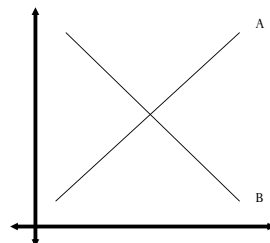
A 2 X 2 factorial design...

No interaction
between factors

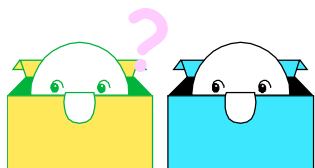


A 2 X 2 factorial design...

Interacting factors



Questions or Comments



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THANK YOU