EXPERIMENTAL RESEARCH

Replication pattern

- When the partials replicate or reproduce the same relationship that existed in bivariate table prior to control
- Control has no effect.

The specification pattern

- When one partial replicate the same relationship but others do not.
- The researcher can specify in which partial there is strong relationship and where it is not.

The suppressor variable pattern

- When the bivariate table suggests independence of X and Y but the relationship appears in one or more partials.
- The control variable is suppressor – the true relationship appears in partials.

Multiple regression analysis

- Controls for many alternative explanations and variables simultaneously.
- Referred to course on statistics.
- Also there are a number of statistical tests that can be applied to test the hypothesis. Here again reference has to be made to course on statistics.

Logic of experiments in natural sciences

- Applied in experiments on human social behavior.
- Experiments are found in psychology, education, criminal justice, journalism, marketing, nursing, political science, social work, and sociology.
- Logic: *Control* the research situation, and evaluate the *causal* relationship among variables

In experiments

- The researcher manipulates a single variable and holds constant all others, extraneous variables.
- The way events are controlled in experiments is not possible in a survey.
- The researcher gains the confidence that his experimental treatment is the cause of the effect he measures.

In experiments

- Theoretically there is high degree of control on the research situation.
- X is manipulated and its effect on Y is measured.
- The effect of all other variables is controlled.
- Researcher creates an artificial situation or deliberately manipulates a situation.

To establish causal relationship between X and Y

- All three conditions to be met:
- 1. X and Y should co-vary.
- 2. X should precede Y.
- 3. No other factor should possibly cause change in Y.
- By controlling all other factors that can affect Y allows the researcher to say that x and x alone causes Y. Not possible to control other factors in an organization where some events occur naturally.

Parts of experiments:

- No fixed number. Usually seven parts:
- 1. Treatment or independent variable
- 2. Dependent variable.
- 3. Pretest
- 4. Posttest
- 5. Experimental group.
- 6. Control group.
- 7. Assignment of subjects

Treatment or independent variable

- The experiment has some degree of control over X. Values can be manipulated.
- Treatment is what researcher modifies.
- Term comes from medicine: a physician administers a treatment to patients.
- Physician intervenes in a physical or psychological condition to change it. Hence it is X variable or the combination of many Xs.

Experimenter creates a situation

- Degree of fear – levels are high-fear or low fear.
- The researcher puts the subjects into either high-fear or low-fear situation.

Dependent variable

- The criterion or standard by which results are judged.
- Assumption: changes in Y are a consequence of changes in the X.
- The outcome of experimental research are the physical conditions, social behaviors, attitudes, or beliefs of subjects that change, in response to treatment.
- Measure Y by observations, interviews, or physiological responses (e.g. heartbeat)

Pretests and Posttests

- Frequently a researcher measures the Y more than once during an experiment.
- *Pretest* is the measurement of Y prior to treatment.
- *Posttest* is the measurement of Y after the treatment introduced into the experimental situation.

Experimental and Control groups

- Divide subjects into 2 or more groups for purposes of comparison.
- A simple experiment has only 2 groups, only one of which receives the treatment.
- Experimental group is the one that receives the treatment or in which treatment is present.
- Group that does not receive the treatment is control group.
- When X has many different values, more than one experimental group is used.

In a simple experiment

- Only two values of the X are manipulated.
- E.g. Consider measuring the influence of a change in work situation, such as playing music during working hours, on employee productivity.
- In the experimental condition (the treatment administered to the experimental group), music is played during working hours.
- In control group (treatment not administered) no change in work situation.
- Productivity in the two groups is compared at the end to determine the effect of X.

Several treatment levels

- The music/productivity experiment with one experimental and on control group may not tell the researcher everything about the relationship
- For understanding the functional nature of relationship between music and productivity at several treatment levels, additional experimental groups with music played for 2 hrs, only for 4 hrs, and only for 6 hrs.
- Allows the experimenter to get a better idea about the impact of music on productivity.

Assignment of Subjects/Test Units

- Social researchers frequently want to compare.
- Compare cases that do not differ. Requires:
- Groups should be similar in characteristics
- Change in Y is presumably the outcome of the manipulation of X variable, having no alternative explanations.

Random assignment

- Ramdomization is a method for assigning the cases (individuals, organizations) to groups for making comparisons.
- It is a way to divide or sort a collection of cases into 2 or more groups in order to increase one's confidence that the groups do not differ in a systematic way.
- In a mechanical method; the assignment is automatic, and the researcher cannot make assignments on the basis of personal preference or the features of specific cases.

Random assignment (cont.)

- Random assignment is random in statistical/
- In every day speech, random means unplanned, haphazard, or accidental, but it has special meaning in mathematics.
- Random describes a process in which each case has a known chance of being selected.
- A random process is the one in which all cases have an exactly equal chance of ending up in one or the other group.
- It is unbiased.
- Makes the groups identical, except for treatment

Matching

- Matching the subjects on the basis of pertinent background information is another technique for controlling assignment errors.
- Matching presents a problem: What are the relevant characteristics to match on, and can one locate exact matches. Cases could differ in a number of ways.
- Randomization preferred. Takes care of contaminating factors.

Three types of controls

- Manipulation: control over stimulus/treatment.
- Holding conditions constant i.e. control over the environment (the confounding factors).
- Control over the composition of groups – balancing. Find out the way that individual differences do not confound the X variable under investigation. Randomization is the answer.

Steps in Conducing an Expt:

- Begin with an hypothesis.
- Decide on an Exp design to test H.
- Decide how to introduce X.
- Develop a measure of Y.
- Set up an experiment and do pilot testing.
- Locate appropriate subjects.
- Randomly assign subjects to groups and give instructions.

Steps Cont.

- Gather data for the pretest of Y.
- Introduce the X to experimental group only and monitor all groups.
- Gather data for posttest of Y.
- Debrief the subjects by informing them of the true purpose of experiment.
- Examine data, make comparisons between groups. Test Hypothesis.

Types of Designs

- Researchers combine parts of an experiment (e.g. pretests, control groups) together into an experimental design.
- E.g. some designs lack pretests, some do not have control groups, others have many experimental groups.
- Classical experimental design has: random assignment, a pretest and posttest, an experimental group and a control group.
- Other designs are variations of classical design

Quasi Experimental Designs:

- One-shot case study design. One group posttest only design.
- One group experiment→
- Pretest (O1) X Posttest (O2). No control group for comparison. [O2 - O1] = Effect
- Two groups experiment → posttest with experimental and control group →

Exp. Group	X	O1
Control Group	-	O2

[O1 – O2] = Treatment Effect.

True Experimental Designs:

- Includes exp and control group. Pretest and posttest to both groups. X only in experimental group. (Ex-post facto experimental design.)
- Exp: Pretest (O1) X Posttest (O2)

  Con: Pretest (O3) - Posttest (O4) Randomization for group set up.
- [(O2-O1) – (O4-O1)] = Treatment effect

Solomon 4 Group Design:

- To gain more confidence, it is advisable to set up 2 exp groups and 2 cont groups. One exp and one control group be given both pretest and posttest. Other two are given posttest only.
- Exp: Pretest (O_1) X Posttest (O_2)
- Con: Pretest (O_3) - Posttest (O_4)
- Exp: - X Posttest (O_5)
- Con: - - Posttest (O_6)
- ($O_2 – O_1$) = E ($O_2 – O_4$) = E
- ($O_5 – O_6$) = E ($O_5 – O_3$) = E
- [($O_2 – O_1$) – ($O_4 – O_3$)] = E
- If all Es are similar, the cause and effect relationship is highly valid.

Interaction Effect:

- Effect of 2 variables together is likely to be greater than the individual effect of each. For example:
- Population of smokers → 30% got lung cancer
- Population of nonsmokers but living in a smoggy climate → 10% got lung cancer.
- Pop of smokers + living in smoggy area → 45% got lung cancer instead of (30+10) 40%.
- Difference between 45-40= 5 is the interaction effect (smoking + smoggy climate)

In experiment

- Interaction between treatment + sensitization due to the instrument.
- Exp: Pretest (O1) X Posttest (O2)
- Con: Pretest (O3) - Posttest (O4)
- Why difference in O4 and O3? *Sensitization*.
- Exp: - X Posttest (O5)
- (O2 – O1) = D
- (O4 – O3) = D/
- (O5 – O3) = D//
- D – [D/ + D//] = Interaction effect.

Further Experimental Designs:

- Randomized Block designs.
- Latin square Design.
- Natural Group Design.
- Factorial Design.

Validity in Experiments

- Validity refers to confidence in cause and effect relationship.
- Internal validity is high in Laboratory experiments.
- External validity (generalizability) is not sure.

Factors Affecting Internal Validity:

- History Effect: Other historical events may affect the X – Y relationship. In addition to advertisement --- something else happens (Virus, some legitimacy)
- Maturation Effect: With passage of time, biological and psychological maturity. Growing older, getting tired, feeling hungry
- Testing Effect: Pretests. Sensitization.
- Instrumentation Effect: Change in measuring instrument between pretest and posttest.

Factor Cont.

- Selection Bias Effect: Improper or unmatched selection of subject for groups.
- Statistical Regression: If extremes are taken then they tend to regress towards mean. Those who are at either end of the extreme would not truly reflect the cause and relationship.
- Mortality: Attrition of subjects. Subject loss. Random groups do not remain comparable.
- Mechanical Loss: Equipment failure

Factors Cont.

- **Experimenter Expectancy: May indirectly communicate desired findings to subject.**
- ***The double blind experiment* is designed to control EE. Both the subjects and those in contact with them are blind to details of the experiment.**

Ethical Issues in Lab Experiments:

- Putting pressure on subjects to participate.
- Asking demeaning question.
- Deceiving subjects by deliberately misleading them.
- Exposing participants to physical or mental stress.
- Not allowing subjects to withdraw.
- Using results to disadvantage the subjects
- Withholding benefits from control group.

Validity in Experiments

- Validity refers to confidence in cause and effect relationship.
- Internal validity is high in Laboratory experiments. Controlled environment.
- External validity (generalizability) is not sure. Organizational or field setting. Several confounding variables. Field experiments have more external validity but less internal validity.
- First have lab exp then test in field setting.

Factors Affecting Internal Validity

- Even the best designed lab studies get influenced by some factors.
- Some confounding factors that can pose threat to internal validity. Sensitization.

1. History Effect

- Other historical (unexpected) events may affect the X – Y relationship. In addition to advertisement --- something else happens (Virus, some legitimacy, some chemical like formaline used as preservative in packed milked) e.g. a bakery is studying the effects of adding nutrients to its bread on 14 yr old within 30 days. Health status (X) treatment on 20th day outbreak of flue affecting children in experiment. Unforeseen event of history.

2. Maturation Effect

- With passage of time, biological and psychological maturity; operating within the subject. Growing older, getting tired, feeling hungry, getting bored. Affect the Y
- Introduce technology and see its effect after 3 months. Is this technology effect or just the experience?

3. Testing Effect

- Pretests given to subjects (questionnaire)
- Exposure to pretest influences posttest.
- Pretest of Job satisfaction (Y before) Treatment (X) Posttest of job satisfaction. Role of sensitization.

4. Instrumentation Effect

- Change in measuring instrument between pretest and posttest.
- Performance measured by i). the units of output, 2). number of units rejected, and the amount of resources expended to produce the units.

5. Selection Bias Effect

- Improper and unmatched selection of subject for groups.

6. Statistical Regression

- If participants chosen for experimental group have extreme scores on the dependent variable to begin with then laws of probability say that those with very low scores on a variable have a greater probability to improve and scoring closer to mean on the posttest after treatment. This phenomenon of low scorers tending to score closer to the mean is known as "regressing toward the mean."
- Likewise, those with high scores have a greater tendency to regress toward the mean – will score lower on the posttest than on pretest.
- The extremes will not 'truly' reflect the causal relationship. Threat to internal validity.

7. Mortality

- Attrition of subjects. Subject loss. Affects the group composition. Random groups don't remain comparable.
- Reaction of those who had left and those who stayed could be different

8. Mechanical loss

- Equipment failure

9. Experimenter Expectancy

- Experimenter's behavior may threaten causal logic.
- May indirectly communicate the desired findings to subjects. Just by explaining the hypothesis. Study the reactions of subjects to the disabled. Explaining the gender differences. Females expected to react differently (being more sensitive to disabled) try to react differently from males.
- *Double blind experiment*: to control experimenter expectancy. Both the subjects and experimenters are blind to details of experiment.
- *Placebo* – a false treatment that appears to be real

External Validity

- Even if the researcher eliminates all concerns for internal validity, external validity remains a potential problem.
- *External validity* is the ability to generalize experimental findings to real life situations.
- Without external validity, findings are of little use for both basic and applied research.
- Threats to external validity:

Reactivity

- Subjects may react differently in an experiment than they would in real life; because they know they are in a study.
- The *Hawthorn effect*, a specific kind of reactivity
- Researchers modified many aspects of working conditions and measured productivity. Productivity rose after each modification.
- Workers did not respond to treatment but to the additional attention they received (being in the experiment and being the focus of attention.
- Demand characteristics another type of reactivity. Change behavior as demanded.

Ethical Issues in Lab Experiments

- Subjects to be fully informed. Subjects' right. Deceiving subjects by deliberately misleading them – unethical. Demand characteristics can invalidate an experiment. Ethics of not providing complete information.
- Debriefing necessary. Providing subjects with all the pertinent facts about the nature and purpose of the experiment. Could relieve the stress. Provide educational experience

Ethical Issues [continued]

- Putting pressure on subjects to participate. Coercion or applying social pressure.
- Giving menial tasks and asking demeaning question. Diminish self respect.
- Exposing subjects to physical or mental stress.
- Not allowing subjects to withdraw.
- Using results to disadvantage the participants.

Ethical Issues [continued]

- Not explaining the procedures to be followed in the experiment.
- Not preserving the privacy and confidentiality of information given by subjects
- Withholding benefits from control groups (incentives – training – offered to exp groups but not to control group). Debatable.

Human Subjects Committee

- To protect the rights of participating subjects.
- Ethics Committee on Research are working who ensure that no violation of human right occur