FCE 3900
EDUCATIONAL RESEARCH
EXPERIMENTAL AND QUASI EXPERIMENTAL RESEARCH
Research Design: Causal Research

• Causality may be thought of as understanding a phenomenon in terms of conditional statements of the form “If x, then y.”
• This type of research is intended to determine the cause for (CAUSAL) or the consequences of differences between groups of people (CAUSAL-COMPARATIVE)
• Causal relationships are typically determined by the use of experiments, but other methods are also used.
What is causal research?

Casual Research explores **the effect of one thing on another** and more specifically, **the effect of one variable on another**. The research is used to measure what impact a specific change will have on existing norms and allows market researchers to predict hypothetical scenarios upon which a company can base its business plan.
For example, if a clothing company currently sells blue denim jeans, casual research can measure the impact of the company changing the product design to the colour white. Following the research, company bosses will be able to decide whether changing the colour of the jeans to white would be profitable. To summarise, casual research is a way of seeing how actions now will affect a business in the future.
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HOW MRS PAVLOV WOULD CALL HER SON, IVAN, TO THE DINNER TABLE
Hey, Einstein! How about working on a cure for insensitivity to other species?

Stale King Features

Happy Birthday, Ashley 6-4-03
Experiments

• An experiment is defined as manipulating (changing values/situations) one or more independent variables to see how the dependent variable(s) is/are affected, while also controlling the affects of additional extraneous variables.
  • Independent variables: those over which the researcher has control and wishes to manipulate i.e. package size, ad copy, price.
  • Dependent variables: those over which the researcher has little to no direct control, but has a strong interest in testing i.e. sales, profit, market share.
  • Extraneous variables: those that may effect a dependent variable but are not independent variables.
• Experimental research is the most conclusive of scientific methods.

• Simplest experiment: two contrasting methods are compared while controlling all other variables that might affect the outcome of the experiment.

• Method of control: same time frame, same treatment material, same age etc.

• Single subject experimental research: involves intensive study of a single individual or group over time.
Experimental Design

• An experimental design is a procedure for devising an experimental setting such that a change in the dependent variable may be solely attributed to a change in an independent variable.

• Symbols of an experimental design:
  • O = measurement of a dependent variable
  • X = manipulation, or change, of an independent variable
  • R = random assignment of subjects to experimental and control groups
  • E = experimental effect
Experimental Design

- After-Only Design: X $O_1$
- One-Group, Before-After Design: $O_1 \times O_2$
- Before-After with Control Group:
  - Experimental group: $O_1 \times O_2$
  - Control group: $O_3 \quad O_4$
  - Where $E = (O_2 - O_1) - (O_4 - O_3)$
How Valid Are Experiments?

• An experiment is valid if:
  • the observed change in the dependent variable is, in fact, due to the independent variable (internal validity)
  • if the results of the experiment apply to the “real world” outside the experimental setting (external validity)
Types of Experiments

- Laboratory experiments: those in which the independent variable is manipulated and measures of the dependent variable are taken in a contrived, artificial setting for the purpose of controlling the many possible extraneous variables that may affect the dependent variable.

- Field experiments: those in which the independent variables are manipulated and measurements of the dependent variable are made on test units in their natural setting.
TYPES OF EXPERIMENTAL DESIGNS

- Simple True Experimental
- Complex True Experimental
- Quasi-Experimental
TYPICAL SCENARIOS:

- Surveys and focus groups data are merged and compared.
- Survey is first completed and then focus groups used as a follow-up to explain the quantitative results.
- Focus groups are first conducted. Information learned is then used to construct an instrument for a follow-up with a random sample.
- An experiment is conducted and qualitative data are collected before the experiment begins and after the experiment has concluded.
- A longitudinal study is underway with multiple studies organized to address a single overarching research objective. The studies are both quantitative and qualitative.
Experimental design is a procedure for devising an experimental setting such that a change in a dependent variable may be attributed solely to the change in an independent variable.
CLASSES OF RESEARCH DESIGN

- Pre-experimental
- Experimental
- Quasi-experimental
PRE-EXPERIMENTAL DESIGNS: NO CONTROL GROUP AND/OR RANDOMIZATION

• One-shot case study
• One-group pretest-posttest design
• Intact-group comparison
A “true” experimental design is one that truly isolates the effects of the independent variable on the dependent variable while controlling for the effects of any extraneous variables.

- Posttest-only control-group design
- Pretest-posttest control-group design
- Factorial experimental design
JENIS REKA BENTUK EKSPERIMENT

- RB Hanya Kawalan Pasca Ujian (Post-test Only Control Group Design)
- RB Kumpulan Kawalan Pra & Pasca Ujian (Pre & Post-tests Control Group Design)
- RB Solomon Empat Kumpulan (Solomon Four-group Design)
1. RB HANYA KAWALAN PASCA UJIAN

- ada 2 kumpulan sahaja (E & K)
- tiada praujian

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2. RB KUMPULAN KAWALAN PRA & PASCA UJIAN

- Reka bentuk eksperimen asas
  - Kesan praujian

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3. RB SOLOMON EMPAT KUMPULAN

- Sebahagian besar p/u ekstranusaus dikawal

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QUASI-EXPERIMENTAL DESIGNS: CONTROL GROUP BUT NO RANDOMIZATION

- Non-equivalent control group design
- Time-series designs
- Others
QUASI-EXPERIMENTAL DESIGN

THE WORD "QUASI" MEANS AS IF OR ALMOST, SO A QUASI-EXPERIMENT MEANS ALMOST A TRUE EXPERIMENT.
WHY QUASI-EXPERIMENT?

- Named as Quasi-Experimental because of the research done almost resembles the experimental design, except that there is no random distribution.
- Random distribution is difficult to do in certain situations such as attribute variables (gender, race, guardians income, etc.) because it will affect variables such as alienated feelings in the new group and so on. Therefore this design is used.
- Quasi-experimental design methodology is not exactly an experiment because there is no random distribution.
- Kaedah reka bentuk quasi-eksperimen bukan sebenar-benar eksperimen kerana tiada pembahagian rawak dilakukan.
- Use the existing groups (intact group).

Quasi-experimental Design
QUASI-EXPERIMENTAL DESIGNS;
are usually constructions that already exist in the real world. Those
designs that fall into the quasi-experimental category fall short in
some way of the criteria for the true experimental group. A quasi-
experimental design will have some sort of control and experimental
group, but these groups probably weren't randomly selected.
Random selection is usually where true-experimental and quasi-
experimental designs differ.

Some advantages of the quasi-experimental design include:

• Greater external validity (more like real world conditions)

• Much more feasible given time and logistical constraints

Disadvantages:

• Not as many variables controlled (less causal claims)
CHARACTERISTICS OF QUASI-EXPERIMENTAL DESIGN

• Two or more groups of respondents that are not randomly distributed.
• Requires decisive control over external variables.
• Prioritize the difference between respondent groups naturally.
The difference between the experimental and quasi-experimental

True and Quasi-Experimental Designs.

Reading Activity: Please read the article entitled;
EXPERIMENTAL AND QUASI-EXPERIMENTAL RESEARCH DESIGN
Important Issues:

- Primary purpose should be developing cause-and-effect relationships when experimentation is not possible
- The “intervention” must have already occurred
- Must identify and consider extraneous variables
- Differences between the groups not due to the independent variable should be controlled
CAUSAL-COMPARATIVE STUDIES

Go beyond relationships/associations to examine cause-and-effects.

Two types of these studies:
• Ex Post Facto
• Correlational
Causal-comparative research is a useful tool that can be employed in situations where experimental designs are not possible. The researcher must remember, however, that demonstrating a relationship between two variables (even a very strong relationship) does not "prove" that one variable actually causes the other to change.
Three Types of Evidence to Confirm Cause-effect relationship

1. Statistically significant relationship between the independent and dependent variables exist validly.

2. Independent variables existed before the dependent variable.

3. Other variables do not affect the dependent variable.
CAUSAL-COMPARATIVE STUDIES
EX POST FACTO

- Applied when seeking cause-and-effect relationships, but cannot do experiments
- One or more independent variables are used to study their effects on one dependent variable
- Ex: What is the impact of a particular training on job performance
Ex. Continued:

- Approach 1: Select two groups, one group is trained, the other is not. Next their job performance is measured (experimental design).
- Approach 2: Look for groups with pre-existing conditions and compare their job performance. e.g., select a group that is already trained and one that is not trained and compare their job performance.
- The groups selected must be as close as possible except for the independent variable.
CAUSAL-COMPARATIVE RESEARCH

"ex post facto"

Example: Compare two groups of students who already belong to either Type A Family or Type B family to see if being in Type A or Type B family brings about differences in achievement.

However, the causality cannot be definitive. A conclusion may be drawn about the differences in achievement but not the cause of the difference.
CAUSAL-COMPARATIVE STUDIES

CORRELATIONAL

These studies use more sophisticated versions of correlation analysis to investigate cause-and-effects

- **Path Analysis:**
  A causal model is developed from theory which shows by arrows the causal sequence that is expected. Correlation between these variables is used as empirical evidence of the proposed links.

- **Newer, more sophisticated methods:**
  - Structural Equation Modeling
  - Latent Variable Causal Modeling
Ex post facto

- The Latin term "Ex post facto" means, in a UK legal context: "by reason of a subsequent act".

Ex-post-facto designs ("after the fact")

From what is done afterwards
• Studies that investigate possible cause and effect relationships by observing an existing condition or state of affairs and searching back in time for plausible causal factors.
Ex Post Facto (Causal-Comparative) Research

- Explores possible causes and effects.
- The independent variable is not manipulated, it has already been applied.
- Focuses first on the effect, then attempts to determine what caused the observed effect.
The *ex post facto* design is a variation of the "after-only with control group" experimental design. The chief difference is that both the experimental and control groups are selected after the experimental variable is introduced rather than before. This approach eliminates the possibility that participants will be influenced by an awareness that they are being tested.
This type of study is very common and useful when using human subjects in real-world situations and the investigator comes in "after the fact." For example, it might be observed that students from one town have higher grades than students from a different town attending the same high school. Would just "being from a certain town" explain the differences? In an *ex post facto* study, specific reasons for the differences would be explored, such as differences in income, ethnicity, parent support, etc.
CHARACTERISTICS OF EX POST FACTO

- Researcher takes the effect/dependent variable and examines it retrospectively.
- Establishes causes, relationships or associations and their meanings.
- Researcher has little to no control over independent variables.
- Flexible by nature.
Characteristics of Ex Post Facto Research

- There is a control or comparison group.
- Intact groups are used.
- The treatment is not manipulated, it has already occurred.
Characteristics of Ex Post Facto Studies

- There may be both “treatment” and “control” groups, however these will be existing, not assigned by the researcher.

- There is no manipulation of conditions.
EX POST FACTO RESEARCH

- Researcher cannot manipulate some variables and therefore selects participants that have certain values for those variables by themselves (gender, personality, illness, ...)

**Pros**
- Often only possible approach

**Cons**
- Selection threat to internal validity: probably not only independent variable differs among participants
* The experimenter does not manipulate the IV... that is subjects cannot be randomly assigned to the levels of the IV.
* Rather they assign themselves because the IV is not manipulated. Ex post facto also qualifies as a descriptive technique
WHEN TO USE THIS?

- You can use this where more powerful experimental designs are not possible; when you are unable to select, control and manipulate the factors necessary to study cause and effect relationships directly, or when control variables except a single independent variable may be unrealistic and artificial.
# EX POST FACTO

## ADVANTAGES AND DISADVANTAGES

### Advantages
- Show a correlation where more rigorous experimentation is not possible
- Exploratory tool
- Useful to avoid artificiality in the research.
- Shows cause and effect relationships

### Disadvantages
- Lack of control for independent variable and randomizing subjects.
- Never certain if causative factor has been included or identified
- Relationship between two factors does not est. cause and effect.
- May be regarded as too flexible.
• Involves the comparison between the pre-existing groups

Example: Investigate the pupils who learn English by watching TV broadcasts and compare their performance to examine whether watching English programs on TV can help to improve the performance of the subject. Pupils are grouped in several groups according to their frequency of watching the broadcast.
Examples of Ex Post Facto Studies

- What is the effect of day care on the social skills of children?

- What is the relationship between participation in extracurricular activities and self concept?
Depression in rape victims

- **EX POST FACTO - EXAMPLE**

- **AVERAGE DEPRESSION SCORE**

- **Victim**
  - Linear decrease in depression score over months

- **Control**
  - Decrease in depression score over months

- Months:
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14

- Depression scores:
  - 0
  - 2
  - 4
  - 6
  - 8
  - 10
  - 12
  - 14
RESEARCH DESIGN

\[ X_1 = \text{rape victim} \]

\[ X_2 = \text{control} \]

\[ Y_{ij} = \text{average depression score in group } i, \text{ at time } j \]

---- indicates possible unequality of groups in both conditions
This design emphasizes the reason that expected.

- Example 1: Does remedial education programs improve the performance of 3M poor students?
- Example 2: Does individual counseling programs increase student motivation problem?

Causal interpretation (Cause-effect relationship)

Researchers should ensure that:
- There is a relationship between A and B;
- A comes before B;
- There was no effect of external variables on A, B or A and B interaction.
Two Basic Approaches to Ex Post Facto Research

1. Begin with subjects who differ on an independent variable (such as their principal instrument/voice) and study how they differ on dependent variables (such as levels of performance anxiety or music theory test scores).

2. Begin with subjects who differ on a dependent variable (such as attrition from music--comparing those students who drop out of music with those who persist) and study how they differ on various independent variables (such as how much they practice, how they feel about their relationship with their teacher, how they feel about themselves as musicians, etc.).
Four forms of control:

1. Score changes, taking into account the marks subject to pre and post test.
2. Match subjects according to the distinguishing features of a population.
3. Using only a similar subject.
4. Using statistical analysis such as ANOVA and ANCOVA.
Tips…

- Comparative study must be used when experimental studies can not be done.
- Situation cause must happen before.
- Extraneous variables need to be identified and recorded.
- The difference between the groups should be controlled.
- Cause-effect relationships should be stated with caution!