Quantitative research

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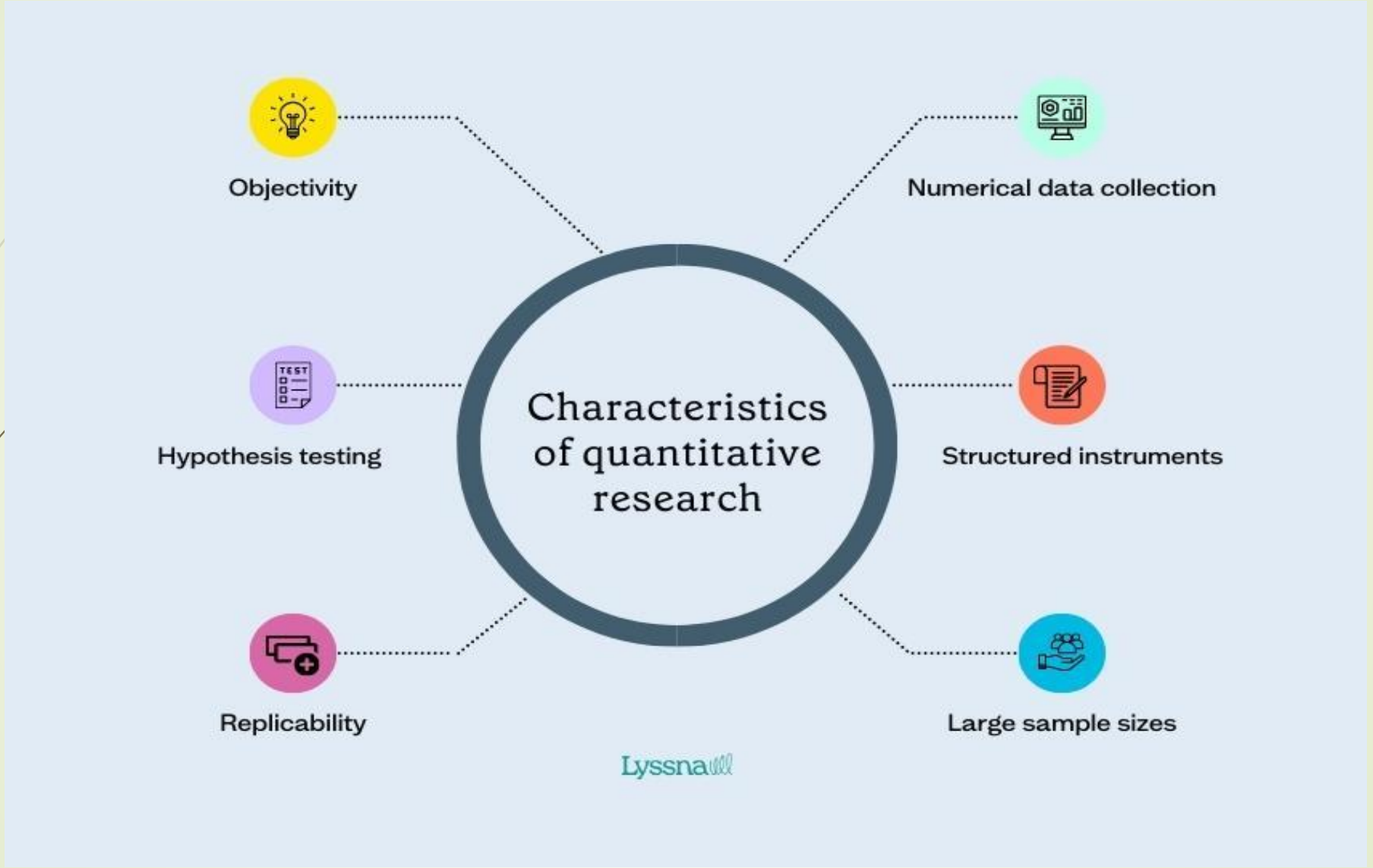
Objectives

In this lecture, students will

- Know what quantitative research is.
- Identify and describe types of quantitative designs.
- Identify and describe quantitative research methods
- Identify and describe types of quantitative analysis.

Quantitative research seeks to describe situations, establish relationships between variables or tries to explain causal relationships. Its purpose is narrow focusing on measurable variables.

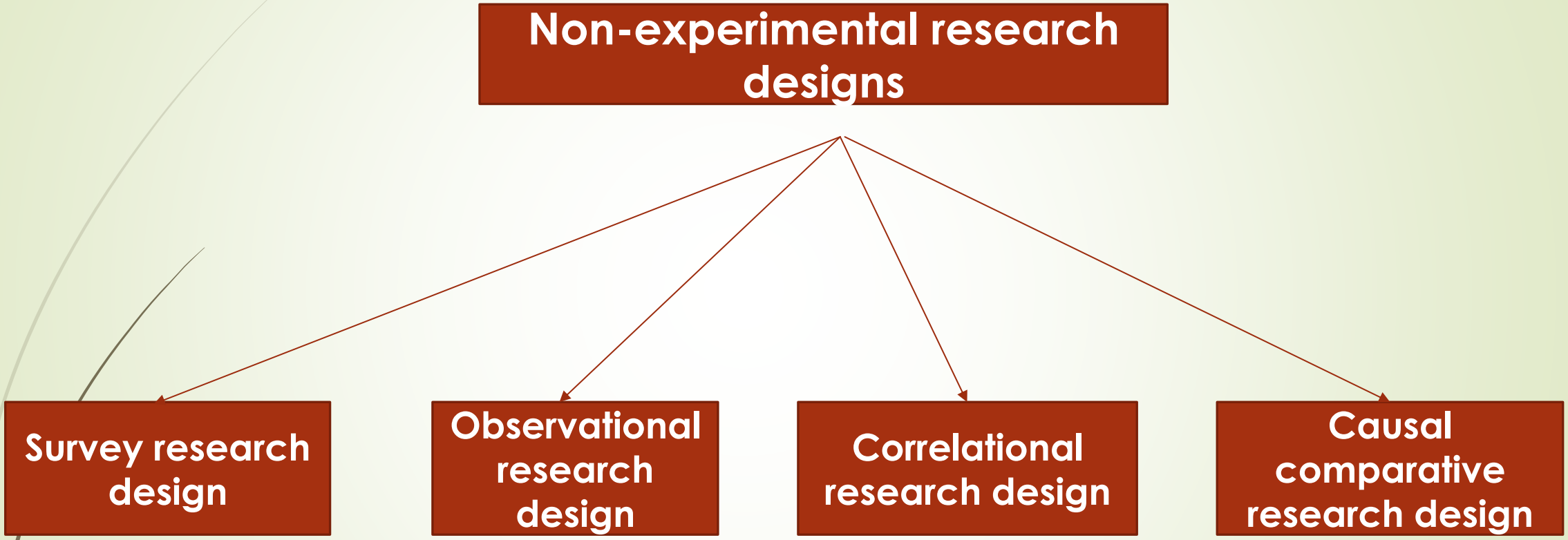
Quantitative research involves data collection procedures that result primarily in numerical data which is then analysed primarily using statistical methods. Typical example: survey research using a questionnaire, analysed by statistical software such as SPSS (Dornëy, 2007, p. 24).


Characteristics of quantitative research
Objectivity
Numerical data collection
Hypothesis testing
Structured instruments
Replicability
Large sample sizes
Lyssna

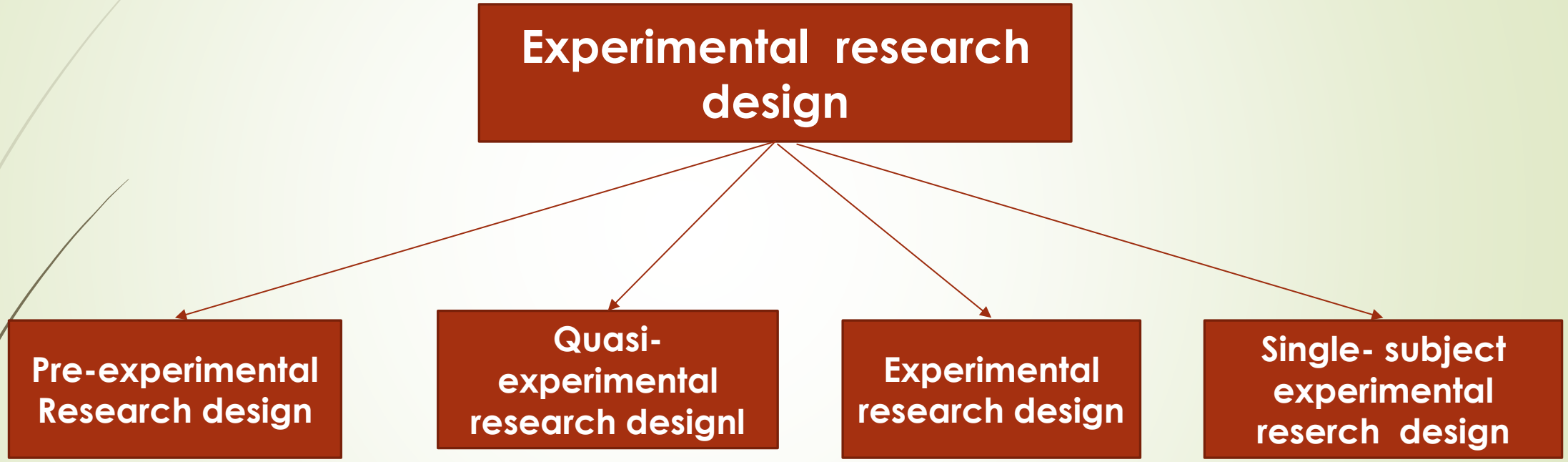
Types of quantitative research

The most important types of quantitative research are presented below

The approaches used in quantitative research fall into two categaries: Non-experimental research designs and experimental research designs. They are descriptive including the following types.



The experimental design consists of a group of techniques during which the researcher uses different treatments to see their effects on the dependent variable.



Survey research design:descriptive research

- The goal of descriptive research is to describe a phenomenon and its characteristics.
- This research is more concerned with what rather than how or why. Therefore, observation and survey tools are often used to gather data (Gall,Gall, & Borg, 2007).
- This kind of research may be qualitative, but it is often analyzed quantitatvely using frequencies, percentages or statistical analysis to determine relationships.
- Such studies look at individuals, groups, institutions, methods and materials in order to describe, compare, contrast, classify, analyse and interpret the entities and the events that constitute their various fields of inquiry (Cohen, 2007, p. 205).

Survey research

- Survey studies aim at describing the characteristics of a population by examining a sample of that group.
- Their purpose is to develop generalizations using a sample that is representative describing the characteristics of a population.
- Surveys are useful mainly for describing patterns in large groups rather than in-depth analysis of individual views (Guthrie, 2010 , p. 77).
- Surveys come in a wide variety of forms, but the most used is the questionnaire. Although survey data can be collected by means of a structured interview, the questionnaire is the main data collection method in surveys (dornËy, 2007, p.101).

Types of surveys

Cross-sectional surveys represent a particular population at a particular time.

Longitudinal surveys repeat cross-sectional surveys (Guthrie, 2010, p. 79).

Observational research

- The distinctive feature of observation as a research process is that it offers an investigator the opportunity to gather 'live' data from naturally occurring social situations (Cohen, 2007, p.396).
- The observation is important in the realm of quatitative research and it is also used to gather quantitative data. The occurrence of the participants behaviour can be counted to determine its frequency.
- A structured observation is very systematic and enables the researcher to generate numerical data from the observation.

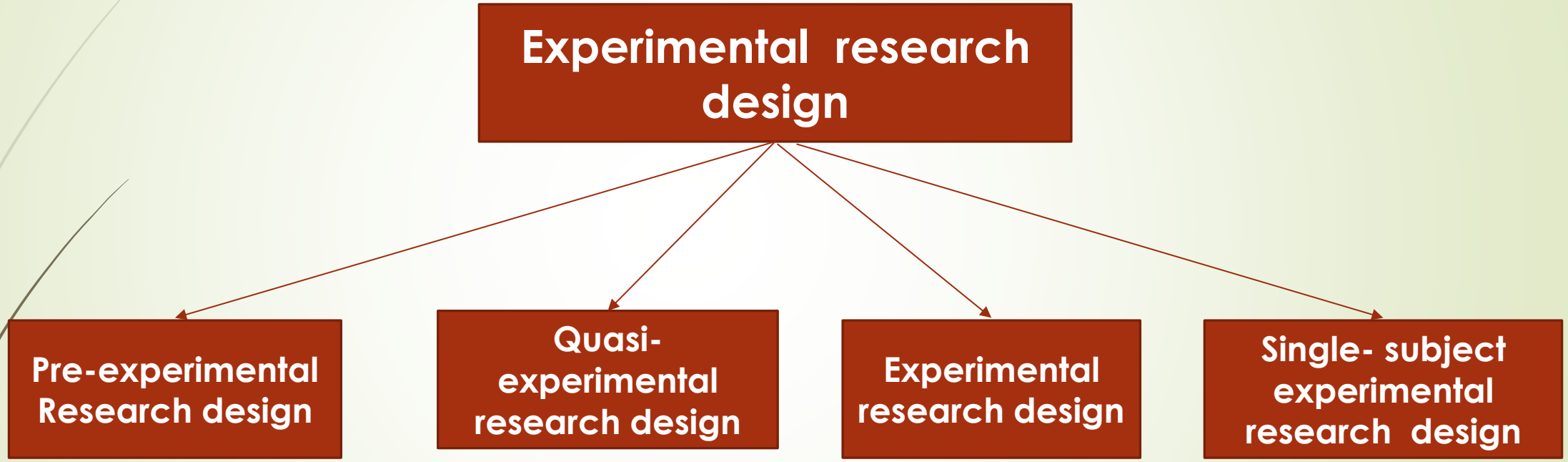
Correlational research

- Correlational research is a quantitative research in which the researcher aims to find out if there is a relationship between variables; its direction (whether it is positive or negative) and its strength.
- Correlational research is carried out for one of two basic purposes—either to help explain important human behaviors or to predict likely outcomes behaviors (Fraenkel, 2012, p. 332).
- This kind of research lacks manipulation.

Causal comparative research/ Ex post facto

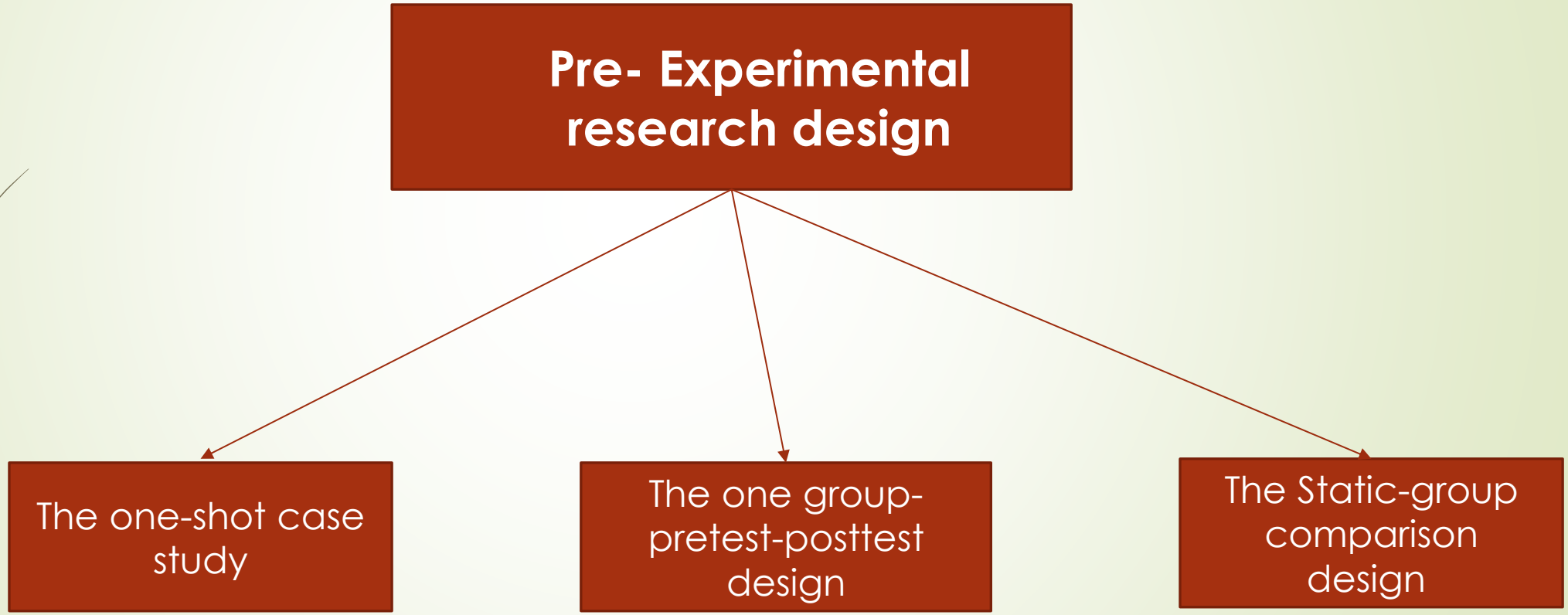
A causal-comparative design is a research design that seeks to find relationships between independent and dependent variables after an action or event has already occurred (Salkind, 2010, p.214)

The experimental design consists of a group of techniques during which the researcher uses different treatments to see their effects on the dependent variable.



Pre-experimental research design

The pre-experimental research design is the simplest form of experimental research. It is a preliminary investigation of the problem before the main one. It is of three types

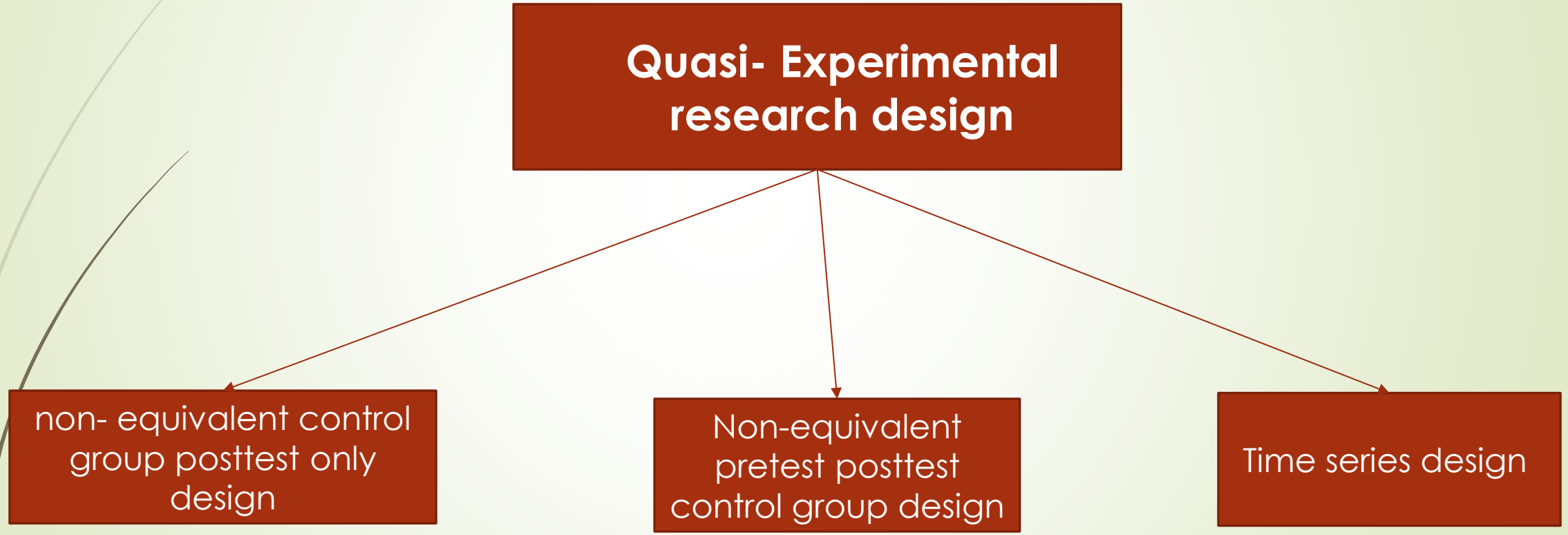


Follow-up

- The one-shot case study design involves a single group exposed to a treatment then posttested.
- The one group pretest-posttest design lacks a control group.
- The Static-group comparison design involves an experimental and a control group bu lack a pre-test.

Quasi-experimental research design

The quasi-experimental research is similar to the experimental design but lacks randomization.

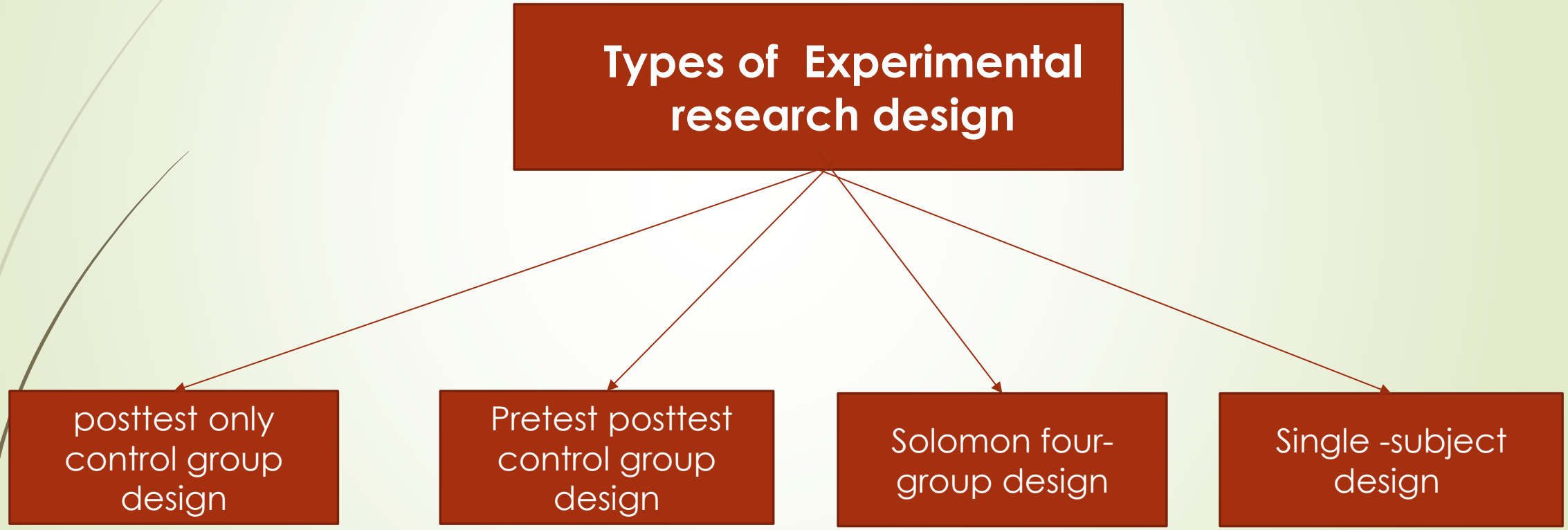


Types of quasi-experimental design

Type of quasi-experimental design	Description
Non-equivalent control group posttest only	Control group (not exposed to a treatment + experimental group (exposed to a treatment) / both posttested
Non-equivalent control group pretest-posttest	A pre-test is added to the first type
Basic -time series design	Observations are made over a period of time before after a treatment (no control group)
Interrupted time- series design	Many observations are made over a period of time before and after a treatment (no control group)
Control series design	A time series design with a non-equivalent group

Experimental research design

True experimental research design involves choosing the participants randomly. Random assignement is one of the most powerful techniques for controlling extraneous threats to validity (Fraenkel et al, 2012).



- **The posttest- only control group design** : the participants are randomly assigned to the experimental and control group.
- **Pretest-posttest control group** design comprises at least two groups. It is considered the most powerful one
- **The solomon four- group design :** this involves four groups randomly selected. Two groups are pre-tested and two are not. Then, one the pre-tested and one of the non-tested receive the treatment. Finally all the four groups receive the posttest.
- **Single- subject research design** is a design that involves studying in detail the behavior of each of a small number of participants mainly in the field of psychology. It consists of measuring the dependent variable repeatedly over time and changing conditions to assess whether the participan's behaviour improved.

Among its types, the reversal design called ABA sudies the effect of a treatment on a certain behaviour, then it is removed and observations are made to check if the behaviour reverses to the initial phase.

Quantitative data analysis

Quantitative analysis involves using numerical data and statistical methods to understand patterns, test hypotheses, and make predictions. Below are the main types, grouped by purpose:

1. Descriptive Quantitative Analysis

- Summarizes and describes the main features of a dataset.
- Common techniques: Mean, median, mode, standard deviation & variance, percentages and frequency distributions and data visualization (charts, histograms)

Example:
Analyzing average monthly sales of a company over a year.

2. Inferential Quantitative Analysis

- Uses sample data to make predictions or generalizations about a population.
- **Common techniques:** Hypothesis testing, t-tests, ANOVA, Chi-square tests…
- **Example:**

3. Predictive Analysis

- **Linear Regression used for predicting continuous outcomes (e.g, test or exam scores).**

Examines how independent variables (attendance, study hours, SES) predict academic performance.

Provides information about strength and direction of relationships.

Example: Attendance Predicting Final Exam Score

Research question: Does **class attendance** predict **final exam performance**?

- Independent Variable (IV): Attendance rate (%)
- Dependent Variable (DV): Final exam score (out of 20)

Multiple Regression

Used for understanding the combined effect of several predictors.

Example: Predicting academic performance using Multiple Factors

Research Question: What factors predict students' GPA?

- IV_1: Attendance rate
- IV_2: Study hours
- IV_3: Parental education level
- DV: academic achievement

Summary of quantitative Analysis

Types quantitative analysis	purpose	Key question	Common technique	example
Descriptive analysis	Summairzes And organizes data	What is happening?	Mean, median, mode, percentages, standard deviation, charts	Calculating the average test score of Grade 10 students
Inferential analysis	Makes generalizations from a sample to a population	Is there a significant difference or relationship?	t-test, ANOVA, chi-square test, correlation, confidence intervals	Determining whether male and female students differ in math performance
Predictive analysis	Forecasts future outcomes based on existing data	What is likely to happen?	Linear regression Multiple regression	Predicting students at risk of failing based on attendance and prior scores

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