Topic 5 ▶ The Research Design

LEARNING OUTCOMES

By the end of this topic, you should be able to:

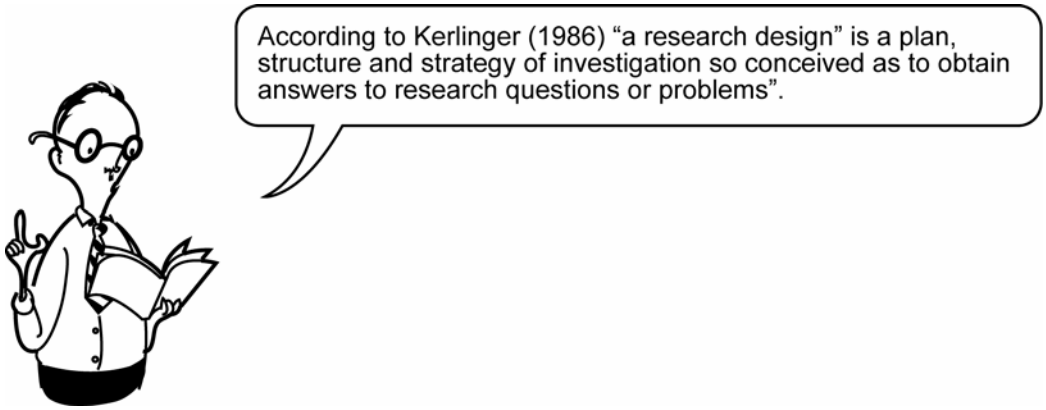
1. Define what is research design;
2. Elaborate the functions of research design;
3. Differentiate the good research designs from the weak research designs; and
4. Analyse the differences between a true experimental design and a quasi-experimental design;

▶ INTRODUCTION

This topic focuses on how we carry out analysis on operating activities, by analysing accrual measures of both revenues and expenses. We will also learn about the net income analysis. Finally, we are going to learn to distinguish the components of income and impact for financial analysis.

5.1 WHAT IS A RESEARCH DESIGN?

Say that you have already decided what you want to study. The next question you should ask yourself is – how are you going to conduct your study? What are the do's and don'ts in the process of undertaking the research? The answer to this question comprises the core of a research design.



A research design is a procedural plan that is adopted by a researcher to answer questions in a valid way. It is very objective and accurate. Normally, a research design will determine the type of analysis you should carry out to get the desired results. To what extent your design is good or bad will depend on whether you are able to get the answers to your research questions. If your design is poor, the results of the research also will not be promising.

How do you go about getting a good research design that will provide sufficient answers to your research work? It is not easy and there is no fixed method to tell others how to do it. The best approach will be to examine different types of research designs, list down the strengths and weaknesses and then make your decisions.

As a research student, you should have a good understanding of your research\problem such as the method that you would like to use in your work, be clear about your research questions and what is it that you intend to establish. In ICT, it is always a good practice to understand the technological context behind every research problem before going in depth. Never select a design and then try to fit the research questions to the design! It should be the other way around. It is very important for you to see if the design could answer your research questions. It is necessary for you to choose a design that will give you the optimised result over factors that explain the research results obtained.

5.2 THE FUNCTIONS OF RESEARCH DESIGN

A research design relates to the identification of procedures and logistical arrangements to start a study and also at the same time emphasises the importance of quality in producing optimised research results. It glues all the components and subcomponents in a research project together. In typical experimental research design, there are a few symbols that a researcher should know which have been widely used to show the design of a study. These symbols are:

R = Random assignment:subjects are assigned in random and into various groupings

X = Means treatment, which maybe design and implementation, performance evaluation, simulation study and so forth

O = Observation or Measurement
(e.g. data rate, baud rate, respond time, bufferring period,etc.)

Generally, we can divide the functions of research design into two:

(a) **Constructing an operational procedure** to execute the tasks required in completing your research work.

(b) **Ensuring these procedures are sufficient** to get valid, objective and answers which are accurate to the questions posed in the research work.

One of the most fundamental aspects of a research design is to specify everything in depth and clear. This is to ensure that a reader will understand what method to follow and how to follow it. A research design should have the following:

(i) Naming the study design (for example as 'comparative', 'cross-sectional' or 'random control')

(ii) How will the study population be identified?

(iii) What are the sampling methods used (we will go further about sampling in the coming topics)?

(iv) What method of data collection will be used in the research work?

(v) How will ethical issues be considered?

SELF-CHECK 5.1

Identify the two functions of research design.

5.3 WEAK DESIGNS

5.3.1 One-shot Design

Let's say you want to examine whether consumer knowledge makes better service provision in e-commerce. You measure e-commerce service provision with the number of transactions. To test this idea, you choose a group of consumers who use e-commerce for purchasing and these consumers with e-commerce knowledge yield higher transactions rate. You conclude that consumers with knowledge of e-commerce increases the number of e-commerce overall transactions. The design is weak for the following reasons:

(a) Selection Bias: The group you selected as subjects might already have some fundamental knowledge about e-commerce.

(b) Background: The organisation of the groups you select might use e-commerce in their daily business transactions, so it might influence the results.

5.3.2 One-Group Pretest-Posttest Design

Using the same example as above, to ensure that there are no pre-existing characteristics among the consumers, a pretest may be administered. If the respondents perform better in e-commerce service provision after being briefed on e-commerce prior to the pretest, then you can attribute it to the frequency of briefing. Table 5.1 summarises the reasons why this design is considered weak.

Table 5.1: Reasons why One-Group Pretest-Posttest Design is weak

	Reason	Explaination
(a)	**Maturation**	If the time gap between the pretest and posttest is long, it is possible that the subjects may have matured due to developmental changes and modification.
(b)	**Testing**	Sometimes the time gap between pretest and posttest is too short and there is possibility that subjects cannot recall on e-commerce usage methodology.

SELF-CHECK 5.2

1. Identify the differences between one-shot design and one-group pretest-posttest design.
2. Why are these designs considered weak?

5.4 TRUE DESIGNS

It is important for us to look into true experimental designs or widely known as 'true designs' in research methodology. In 'true designs', a researcher should have a research design that enables him/her to have control over the situation in terms of assignment of subjects into groups, to decide on who gets the treatment condition and to decide the amount of treatment condition that subjects receive (Christensen 1988). In this topic, we will discuss two major types of 'true design' – after-only and before-after. The major difference between these two designs is that:

(a) the **after-only design** depends on **posttest**

(b) **before-and-after** design depends on a **pretest** and a **posttest.**

5.4.1 The After-only Design

In this design, let us say that a researcher is aware that a population is exposed to an intervention. Therefore, he/she wishes to study its impact on the population. In this design, pretest is usually constructed based on situation before an intervention; or from information available from existing record. In the ICT, **after-only-design** is often used in system verification based research and at times in design and implementation procedures. Figure 5.1 shows the **after-only design**.

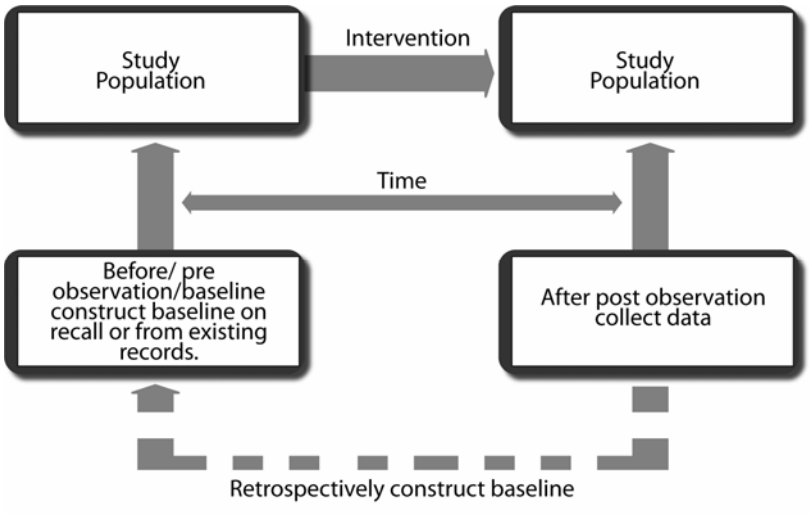


Figure 5.2 : The After-Only Design
Source: Adapted from Figure 8.7 Research Methodology: Ranjit Kumar, page 102

This design is mainly used in IT impact assessment studies. In real-life, many programmes operate without the benefit of a planned evaluation at the programme planning stage. This is due to the fast changing nature of the ICT field and it is not possible to follow strictly the sequence such as collection of baseline information, implementation of programme and then programme evaluation. In normal practice, the adequacy of this design relies on the accuracy of data obtained on the prevalence of incident or impact before an intervention is introduced. Let us take a look at a few examples of situations.

(a) the impact of web services in e-commerce technology;

(b) the impact of decline in network performance of a campus WAN; or

(c) the impact of IT on undergraduate education.

In these types of situations, it is expected that accurate details are kept regarding the scope of the study. Therefore, any change is due to the introduction of intervention or policy changes of the research issue.

5.4.2 The Before-and-after Design

One of the good examples of 'true design' is the **before-and-after** research design. This includes experimental and control groups. This design overcomes the problem of retrospectively constructing the 'before' observation by introducing it before the intervention takes place in the research subject. This design solves the problem with **after-only** design that is comparative of the **before-and-after** observations (Figure 5.2).

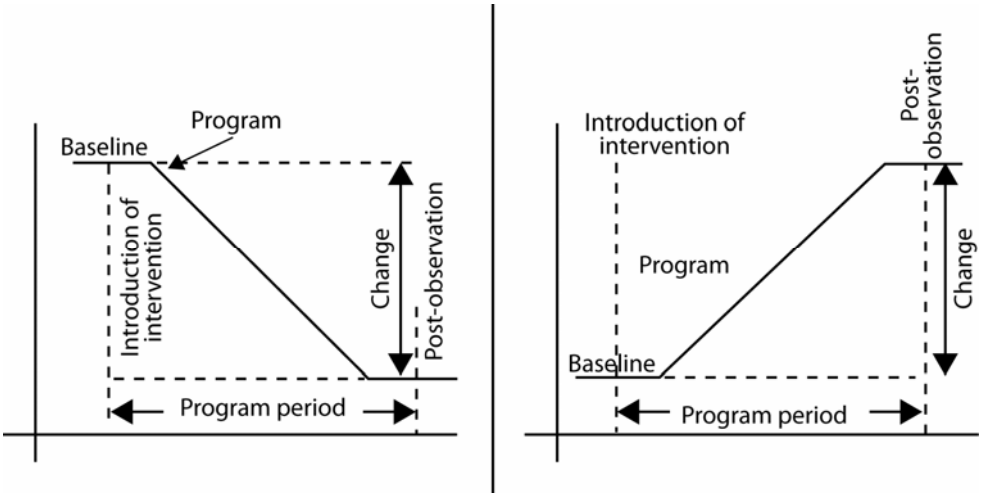


Figure 5.2: Measurement of change through a before-and-after design

SELF-CHECK 5.3

1. What is the core strength of 'true designs' in research?
2. What is the major difference between the two types of true design discussed in this section?

5.5 THE QUASI-EXPERIMENTAL DESIGN

What is meant by Quasi-Experimental Design?

> Quasi-Experimental Design is a design that does not provide full scalable control towards confounding variables.
>
> ~ Chirstensen and Johnson 2000

This could be due to random assignment of samples in a particular study. In some cases, it is not possible to assign samples to groups which require a strong experimental research.

For example, in ICT, there are times when researchers faced with situation where all the requirements of a true design experiment cannot be fulfilled. This scenario is particularly true when dealing with IT impact based research and studies.

5.5.1 Non-Equivalent Control Group Design

This design group contains both experimental and control groups. However, subjects are not randomly assigned to the groups. This means that the subjects in the groups may not be equivalent on all variables defined. In this design, both groups are given first a pretest and then a posttest (once the treatment is given to the experimental group). Both scores of posttest and pretest are compared to each other to check if there is any significant differences. Figure 5.3 below shows the non-equivalent control group design.

	Pretest	Treatment	Posttest
Experiment Group	O	X	O
Control Group	O		O

Figure 5.3: Non-Equivalent Control Group Design
Source: Adapted from www.socialresearchmethods.net

We must know here that we cannot randomly assign subjects, it means we can be sure that extraneous variables or factors will creep into our experiment and threaten its internal validity (we will discuss in depth about validity in the coming topics). A good researcher will take some measures in ensuring the subjects in the experimental and control groups are as similar as possible. In ICT research, it might be important variables such as infrastructure, technology feasibility, ICT testbed and so forth.

5.5.2 Interrupted Time Series Design

This design requires a researcher to take a series of measurements both before and after the treatment. A good example of deployment of this research design is ICT communication research and performance modelling of network. Subjects from a single group will be pretested a number of times during the foundation

phase, exposed to the treatment, and then posted a number of times after the treatment (Figure 5.4). Foundation phase refers to the testing conducted before the treatment to alter behaviour.

Figure 5.4: Interrupted Time-Series Design
Source: Adapted from www.socialresearchmethods.net

SELF-CHECK 5.4

1. What is the meaning of quasi-experimental design?
2. What is defined as non-equivalent control group design?

ACTIVITY 5.1

To learn more about Quasi-Experimental design, visit the following website: http://www.socialresearchmethods.net/kb/quasiexp.php
http://allpsych.com/researchmethods/quasiexperimentaldesign.html

What did you learn from your readings? Share your thoughts on lessons learned from this topic with your coursemates. Post your comments in the myLMS forum. Remember, sharing is caring!

SUMMARY

- A research design consists of strategy and specific procedures in seeking answers to a specific research question.
- A weak research design does not allow controlling extraneous variables into experiment.
- Some examples of weak designs are one-shot design and one-group pretest-posttest design
- A true research design allows us to maintain control over a situation in terms of variables assignment.

- A quasi-experimental design is a design that does not provide full control over variables.
- Examples of quasi-esperimental design are non-equivalent control group design and interrupted time-series.

KEY TERMS

Experimental design
Quasi experimental design
Non-equivalent design
Interrupted time series design
Weak Research design
True design
After – only design
Before-and-after design

DISCUSSION

1. Construct a research case for a true experimental design in ICT.
2. What are Quasi-experimental research designs? How do they differ from true experiments?

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