

# PYSC 224

# Introduction to Experimental Psychology

Session 3 – Nature of scientific methodology

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# Session Overview

- Christensen (2008) identifies three main characteristics of scientific research which are;
  - ❑ 1. controlling extraneous variables to achieve internal validity,
  - ❑ 2. operationally defining terms used in experimentation and
  - ❑ 3. the ability to replicate experiments
- The steps in scientific methodology involves identifying a problem to research, designing and conducting the research through to writing and publishing your research findings

# Session Goals and Objectives

At the end of this session, you should be able to

- Explain the three characteristics of scientific methodology
- Use a diagram to outline the steps in scientific methodology
- Explain how important each step is in the conduct of a research
- Use a practical example to outline the steps you will follow when conducting a research

# Session Outline

The key topics to be covered in the session are as follows:

- Characteristics of scientific research
- Steps in scientific methodology
- Researchable questions/ topics

# Reading List

- Christensen, B.L. (1997). *Experimental Methodology* (7th ed.). Boston: Allyn & Bacon. (p. 14-18)
- Christensen, B.L. (2007). *Experimental Methodology* (10th ed.). Boston: Allyn & Bacon. (p. 1-24, )
- Kantowitz, B. H., Roediger III, H. L., Elmes, D. G. (2015). *Experimental Psychology*. Stamford: Cengage Learning (Pp 63-72)
- Martin, D. W. (2008). *Doing Psychology Experiments*. Belmont, CA: Thomson Higher Education (p. 25-31, 131-147)

Topic One

# CHARACTERISTICS OF SCIENTIFIC RESEARCH

# Characteristics of scientific research

- Christensen (2007) identified three most important characteristics
  - Control
  - Operational definition
  - Replication

# Characteristics of scientific research

## 1. Control

- Control is eliminating any extraneous variable that can affect an experiment
- It is the most important element in scientific methodology
- It enables researchers identify the causes of phenomena they investigate



# Characteristics of scientific research

- If an experiment is not controlled the cause of an effect cannot be isolated
- The observed effect could be due to any one of a combination of the uncontrolled variable
- Example- *The effect of alcohol on task performance*
- Extraneous variables such as prior exposure to the task or tolerance to alcohol intake should be controlled

# Characteristics of scientific research

## 2. Operational definition/ Operationalism

- “*Definition of concepts by the operations used to attain or measure them*” (Christensen, 2007, p.21)
- This is necessary to eliminate confusion in communication

# Characteristics of scientific research

- Example- *Alcohol intake will decrease performance on a task*
- For a hypothesis such as- *Individuals who take in more alcohol will perform poorer than those who take in less alcohol*
- An experimenter has to operationally define “*more alcohol*” and “*less alcohol*”
- Operational definitions must be used to provide communicable knowledge

# Characteristics of scientific research

## 3. Replication

- Data from research must be reliable, the same results must be obtained if the study is repeated
- Replication is performing the same experiment using the same procedure to find out if the same results will be obtained
- Duplicate the results on another group of subjects or, on the same subject

# Characteristics of scientific research

- Replication may result in one of two possible outcomes
- Either the results are
  - a) replicated or
  - b) not replicated
  - a) When it is replicated- it gives additional assurance that the first results are reliable

# Characteristics of scientific research

- b) If it is not replicated- it is possible that results of the initial study were due to chance
- Or replication experiment might have altered some significant element in the experiment
- For instance the instructions given by the experimenter or the use of a different experimenter

Topic Two

# STEPS IN SCIENTIFIC METHODOLOGY

# Steps in Scientific Methodology

- Christensen (1997) identified five steps in scientific methodology
  - 1. Identify a problem and formulate a hypothesis
  - 2. Design the research
  - 3. Conduct the research
  - 4. Test the hypothesis
  - 5. Communicate the research results



# Steps in Scientific Methodology

## 1. Identify a problem and formulate a hypothesis

- Every scientific research begins with identifying a problem
- Identify an issue that one wants to study by observing everyday behaviour or reading about previous research

# Steps in Scientific Methodology

- Refine and narrow the problem identified to make it researchable
- Hypotheses are formulated
- Stated in such a way that they are testable and capable of being refuted
- Should state clearly the relationship that is expected to emerge in the research

# Steps in Scientific Methodology

## 2. Design the research

- The independent, dependent and extraneous variables are the three relevant variables that need special attention
- Specify the independent (levels?) and dependent variables and how extraneous variables will be controlled
- Ensure that the hypotheses stated are those actually tested

# Steps in Scientific Methodology

- The researcher must also decide on the design for the research
- Example- E.g. a correlational study, experimental study, qualitative design etc.
- These procedures are extremely important for the conduct of the research
- They are laid out to overcome any difficulties that could distort the results

# Steps in Scientific Methodology

## 3. Conduct the research

- Making decisions concerning the actual conduct of the experiment
- Before data collection, the researcher must decide,
  - which participants are to be tested
  - what instructions are necessary and
  - what equipment or materials are needed

# Steps in Scientific Methodology

- First, select research participants
- Then manipulate the independent variable
- Ensure that all extraneous variables are controlled
- Then measure the dependent variable

# Steps in Scientific Methodology

- The dependent variable is usually one of three general types,
  - ❑ self-report measures
  - ❑ behavioural measures or
  - ❑ physiological measures
- Discuss examples of these at tutorials

# Steps in Scientific Methodology

## 4. Testing the hypothesis

- Data must be analysed and interpreted to confirm or refute the hypotheses
- Statistical software such as SPSS can be used
- Results must then be interpreted to specify exactly what they mean



# Steps in Scientific Methodology

## 5. Communicate the research results

- Write a research report stating how the research was conducted and what was found
- Results of the research must be communicated to others
- This is often done by publishing the finding in professional journals in a field e.g. Journal of Clinical Psychology etc.

# Steps in Scientific Methodology

- Example- use the step described to outline a research on the topic below.
- *The effect of eating breakfast on students' learning*

# Effect of eating breakfast on learning

1. Identify a problem and formulate a hypothesis



2. Design the research



3. Conduct the research



4. Test the hypothesis



5. Communicate the research results

Topic Three

# RESEARCHABLE QUESTIONS/ TOPICS

# Researchable questions/ topics

- Ensure that your research question is *'researchable'*
- Researchable questions/ topics are ones that can be empirically investigated?
- Good research questions should be
  - Feasible
  - Clearly stated
  - Significant
  - Ethical

# Researchable questions/ topics

- Examples:
- Which approaches taken by University of Ghana will be the most effective ways to ensure cleanliness on campus?
- What is the effect of knuckle-cracking on the development of osteoarthritis among males and females?
- How do employers perceive first class honours students?

# Researchable questions/ topics

- Non-researchable problems include:
  - Explanations of how to do something,
  - Vague propositions,
  - Address philosophical or ethical issues
  - Address opinions
- They cannot be resolved through data collection and analysis

# Steps in Scientific Methodology

- What is the best way to learn to read?
- Are some people born bad?
- Can crime be prevented?
- Is democracy the best form of government?
- Should cell phone use while driving be banned?



# Steps in Scientific Methodology

- What is the best way to learn to read?
- At which age is it better to introduce phonics- age 5, 6 or 7
- Are some people born bad?
- Who commits more crime- poor people or rich people?
- Can crime be prevented?
- Getting youth employed will reduce crime
- Should cell phone use while driving be banned?
- Assessing the effect of cell phone use while driving

**END OF SESSION 3**



# References

- Christensen, B.L. (2007). *Experimental Methodology* (10th ed.). Boston: Allyn & Bacon
- Kantowitz, B. H., Roediger III, H. L., Elmes, D. G. (2015). *Experimental Psychology*. Stamford: Cengage Learning

