UIDLC

PSY 209
Experimental Psychology

Course Manual

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Experimental Psychology

PSY209

University of Ibadan Distance Learning Centre
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Vice-Chancellor's Message

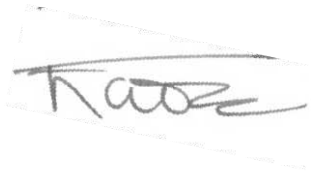
The Distance Learning Centre is building on a solid tradition of over two decades of service in the provision of External Studies Programme and now Distance Learning Education in Nigeria and beyond. The Distance Learning mode to which we are committed is providing access to many deserving Nigerians in having access to higher education especially those who by the nature of their engagement do not have the luxury of full time education. Recently, it is contributing in no small measure to providing places for teeming Nigerian youths who for one reason or the other could not get admission into the conventional universities.

These course materials have been written by writers specially trained in ODL course delivery. The writers have made great efforts to provide up to date information, knowledge and skills in the different disciplines and ensure that the materials are user-friendly.

In addition to provision of course materials in print and e-format, a lot of Information Technology input has also gone into the deployment of course materials. Most of them can be downloaded from the DLC website and are available in audio format which you can also download into your mobile phones, IPod, MP3 among other devices to allow you listen to the audio study sessions. Some of the study session materials have been scripted and are being broadcast on the university's Diamond Radio FM 101.1, while others have been delivered and captured in audio-visual format in a classroom environment for use by our students. Detailed information on availability and access is available on the website. We will continue in our efforts to provide and review course materials for our courses.

However, for you to take advantage of these formats, you will need to improve on your I.T. skills and develop requisite distance learning Culture. It is well known that, for efficient and effective provision of Distance learning education, availability of appropriate and relevant course materials is a *sine qua non*. So also, is the availability of multiple plat form for the convenience of our students. It is in fulfillment of this, that series of course materials are being written to enable our students study at their own pace and convenience.

It is our hope that you will put these course materials to the best use.



Prof. Isaac Adewole

Vice-Chancellor

Foreword

As part of its vision of providing education for "Liberty and Development" for Nigerians and the International Community, the University of Ibadan, Distance Learning Centre has recently embarked on a vigorous repositioning agenda which aimed at embracing a holistic and all encompassing approach to the delivery of its Open Distance Learning (ODL) programmes. Thus we are committed to global best practices in distance learning provision. Apart from providing an efficient administrative and academic support for our students, we are committed to providing educational resource materials for the use of our students. We are convinced that, without an up-to-date, learner-friendly and distance learning compliant course materials, there cannot be any basis to lay claim to being a provider of distance learning education. Indeed, availability of appropriate course materials in multiple formats is the hub of any distance learning provision worldwide.

In view of the above, we are vigorously pursuing as a matter of priority, the provision of credible, learner-friendly and interactive course materials for all our courses. We commissioned the authoring of, and review of course materials to teams of experts and their outputs were subjected to rigorous peer review to ensure standard. The approach not only emphasizes cognitive knowledge, but also skills and humane values which are at the core of education, even in an ICT age.

The development of the materials which is on-going also had input from experienced editors and illustrators who have ensured that they are accurate, current and learner-friendly. They are specially written with distance learners in mind. This is very important because, distance learning involves non-residential students who can often feel isolated from the community of learners.

It is important to note that, for a distance learner to excel there is the need to source and read relevant materials apart from this course material. Therefore, adequate supplementary reading materials as well as other information sources are suggested in the course materials.

Apart from the responsibility for you to read this course material with others, you are also advised to seek assistance from your course facilitators especially academic advisors during your study even before the interactive session which is by design for revision. Your academic advisors will assist you using convenient technology including Google Hang Out, You Tube, Talk Fusion, etc. but you have to take advantage of these. It is also going to be of immense advantage if you complete assignments as at when due so as to have necessary feedbacks as a guide.

The implication of the above is that, a distance learner has a responsibility to develop requisite distance learning culture which includes diligent and disciplined self-study, seeking available administrative and academic support and acquisition of basic information technology skills. This is why you are encouraged to develop your computer skills by availing yourself the opportunity of training that the Centre's provide and put these into use.

In conclusion, it is envisaged that the course materials would also be useful for the regular students of tertiary institutions in Nigeria who are faced with a dearth of high quality textbooks. We are therefore, delighted to present these titles to both our distance learning students and the university's regular students. We are confident that the materials will be an invaluable resource to all.

We would like to thank all our authors, reviewers and production staff for the high quality of work.

Best wishes.

Professor Bayo Okunade

Director

Course Development Team

The University of Ibadan Distance Learning Centre wishes to thank those below for their contribution to this course manual:

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Contents

About this course manual

Experimental PsychologyPSY209 has been produced by University of Ibadan Distance Learning Centre. It is structured in the same way, as other psychology course.

How this course manual is structured

The course overview

The course overview gives you a general introduction to the course. Information contained in the course overview will help you determine:

- If the course is suitable for you.
- What you will already need to know.
- What you can expect from the course.
- How much time you will need to invest to complete the course.

The overview also provides guidance on:

- Study skills.
- Where to get help.
- Course assessments and assignments.
- Activity icons.
- Study sessions.

We strongly recommend that you read the overview *carefully* before starting your study.

The course content

The course is broken down into study sessions. Each study session comprises:

- An introduction to the study session content.
- Learning outcomes.
- Content of study sessions.
- A study session summary.
- Assessments and/or assignment, as applicable.

Your comments

After completing this course, Experimental Psychology, we would appreciate it if you would take a few moments to give us your feedback on any aspect of this course. Your feedback might include comments on:

- Course content and structure.
- Course reading materials and resources.
- Course assessments.
- Course assignments.
- Course duration.
- Course support (assigned tutors, technical help, etc).
- Your general experience with the course provision as a distance learning student.

Your constructive feedback will help us to improve and enhance this course.

Course overview

Welcome to Experimental PsychologyPSY209

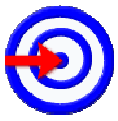
This course provides an introduction to the techniques of research employed in the study of human behaviour. You will gain experience in the conduct of research, including design of simple experiments, observation and measurement techniques, and the analysis of behavioural data in the course of study.

This course manual supplements and complements PSY209 UI Mobile Class Activities as an online course. The UI Mobile Class is a virtual platform that facilitates classroom interaction at a distance where you can discuss / interact with your tutor and peers while you are at home or office from your internet-enabled computer.

Experimental PsychologyPSY209—is this course for you?

PSY209 is a three unit *compulsory* course for psychology students. The course introduces you to scientific methods and procedures involved in theory generation and hypothesis testing and reporting. A basic understanding of research principles will enable you to critically read, comprehend and evaluate research reports that provide the knowledge base in psychology.

Course outcomes



Outcomes

Upon a successful completion of Experimental PsychologyPSY209, you will be able to:

- *use* experimental strategy in scientific investigation, to explain the benefits involved in selecting that strategy and its costs.
- *apply* experimental strategy to questions about behaviour through a critical review of the experimental literature in psychology and employing empirical methods.
- *develop* the skills of experiment report writing using the stylistic conventions of the American Psychological Association (APA).

Timeframe

How long?

This is a 15 week course. It requires a formal study time of 45 hours. The formal study times are scheduled around online discussions / chats with your course facilitator / academic advisor to facilitate your learning. Kindly see course calendar on your course website for scheduled dates. You will still require independent/personal study time particularly in studying your course materials.

How to be successful in this course

As an open and distance learner your approach to learning will be different to that from your school days, where you had onsite education. You will now choose what you want to study, you will have professional and/or personal motivation for doing so and you will most likely be fitting your study activities around other professional or domestic responsibilities.

Essentially you will be taking control of your learning environment. As a consequence, you will need to consider performance issues related to time management, goal setting, stress management, etc. Perhaps you will also need to reacquaint yourself in areas such as essay planning, coping with exams and using the web as a learning resource.

We recommend that you take time now—before starting your self-study—to familiarize yourself with these issues. There are a number of excellent resources on the web. A few suggested links are:

http://www.dlc.ui.edu.ng/resources/studyskill.pdf

This is a resource of the UIDLC pilot course module. You will find sections on building study skills, time scheduling, basic concentration techniques, control of the study environment, note taking, how to read essays for analysis and memory skills ("remembering").

- http://www.ivywise.com/newsletter_march13_how_to_self_study.html

  This site provides how to master self-studying, with bias to emerging technologies.

- http://www.howtostudy.org/resources.php

  Another "How to study" web site with useful links to time management, efficient reading, questioning/listening/observing skills, getting the most out of doing ("hands-on" learning), memory building, tips for staying motivated, developing a learning plan.

The above links are our suggestions to start you on your way. At the time of writing these web links were active. If you want to look for more, go to www.google.com and type "self-study basics", "self-study tips", "self-study skills" or similar phrases.

Need help?

Help

As earlier noted, this course manual complements and supplements PSY209at UI Mobile Class as an online course.

You may contact any of the following units for information, learning resources and library services.

Distance Learning Centre (DLC)
University of Ibadan, Nigeria
Tel: (+234) 08077593551 – 55
(Student Support Officers)
Email: ssu@dlc.ui.edu.ng

Head Office
Morohundiya Complex, Ibadan-Ilorin Expressway, Idi-Ose, Ibadan.

Information Centre
20 Awolowo Road, Bodija, Ibadan.

Lagos Office
Speedwriting House, No. 16 Ajanaku Street, Off Salvation Bus Stop, Awuse Estate, Opebi, Ikeja, Lagos.

For technical issues (computer problems, web access, and etcetera), please send mail to webmaster@dlc.ui.edu.ng.

Academic Support

Help

A course facilitator is commissioned for this course. You have also been assigned an academic advisor to provide learning support. The contacts of your course facilitator and academic advisor for this course are available at onlineacademicsupport@dlc.ui.edu.ng

Activities

Activities

This manual features "Activities," which may present material that is NOT extensively covered in the Study Sessions. When completing these activities, you will demonstrate your understanding of basic material (by answering questions) before you learn more advanced concepts. You will be provided with answers to every activity question. Therefore, your emphasis when working the activities should be on understanding your answers. It is more important that you understand why every answer is correct.

Assessments

Assessments

There are three basic forms of assessment in this course: in-text questions (ITQs) and self assessment questions (SAQs), and tutor marked assessment (TMAs). This manual is essentially filled with ITQs and SAQs. Feedbacks to the ITQs are placed immediately after the questions, while the feedbacks to SAQs are at the back of manual. You will receive your TMAs as part of online class activities at the UI Mobile Class. Feedbacks to TMAs will be provided by your tutor in not more than 2 weeks expected duration.
Schedule dates for submitting assignments and engaging in course / class activities is available on the course website. Kindly visit your course website often for updates.

Bibliography

Readings

For those interested in learning more on this subject, we provide you with a list of additional resources at the end of this course manual; these may be books, articles or websites.

Getting around this course manual

Margin icons

While working through this course manual you will notice the frequent use of margin icons. These icons serve to "signpost" a particular piece of text, a new task or change in activity; they have been included to help you to find your way around this course manual.

A complete icon set is shown below. We suggest that you familiarize yourself with the icons and their meaning before starting your study.

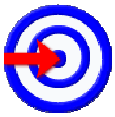
 Activity	 Assessment	 Assignment	 Case study
 Discussion	 Group Activity	 Help	 Outcomes
 Note	 Reflection	 Reading	 Study skills
 Summary	 Terminology	 Time	 Tip

Study Session 1

Approaches to Scientific Knowledge in Psychology

Introduction

In this Study Session, scientific explanations of behaviour and the major goals of psychology as a science will be introduced to you. Through the scientific method and specific research designs, you attempt to develop scientific explanation for behaviour. A scientific explanation for a phenomenon is a tentative explanation, based on objective observation and logic that can be empirically tested.



Learning Outcomes

When you have studied this session, you should be able to:

i. *explain* behaviour using scientific principles.
ii. *differentiate* scientific explanation from common sense explanation of behaviour.

1.1 Scientific Explanations of Behaviour

Scientific explanations a reason that is based on the principles of science.

Objective a judgment that is not influenced by personal feelings or opinions in considering and representing facts.

System observation an objective and organized means of gathering data to confirm or validate criteria.

Although other types of explanations exist, such as those based on common sense or faith, **scientific explanations** are the only kind accepted by scientists. Scientific explanations have a unique blend of characteristics that set them apart from other types (Bordens& Abbott, 2005). These are as follows:

1. **Empirical:** An explanation of behaviour in a scientific method is empirical if it is based on the evidence of the senses. To qualify as scientific, an explanation must be on **objective** and **systematic observation**, often carried out under carefully controlled conditions. If an explanation of behaviour cannot be verified by others, it is not empirical and thus not scientific.
2. **Rational:** An explanation is rational if it follows the rules of logic and is consistent with known facts. An explanation of behaviour does not qualify to be scientific if the explanation makes assumptions that are known to be false, commits logical errors in drawing conclusions from its assumptions, or is inconsistent with established fact.
3. **Testable:** A scientific explanation should be either verifiable through direct observation or lead to specific predictions about what should occur under conditions not yet observed. An explanation is testable if confidence in the explanation could be undermined by a failure to observe the predicted outcome. In other words, one should be able to imagine outcomes that would disprove the explanation.
4. **Parsimonious:** Often more than one explanation is offered for an

observed behaviour. When this occurs, scientists prefer the parsimonious explanation; the one that explains behaviours with the fewest number of assumptions.

5. **General:** A scientific explanation is general. In other words, the explanation are of broad explanatory power over those that "work'' only within a limited set of circumstances.
6. **Tentative:** Scientific explanations are tentative in nature. In other words, despite confidence in scientific explanations, there is possibility that the explanations are faulty and that is why they are tentative.
7. **Rigorously Evaluated:** This characteristic derives from the other characteristics just mentioned, but it is important enough to deserve its own place in the list. Scientific explanations are constantly evaluated for consistency with the evidence, and with known principles, for parsimony, and for generality. In this way, even accepted explanations may be overthrown in favour of views that are more general, more parsimonious, or more consistent with observation.

1.2 Common Sense and Scientific Explanations

During the course of everyday experience, we develop explanations of the events happening around us. Largely, these explanations are based on the limited information available from the observed event and what our previous experience has told us is true. These types of explanations can be classified as **common sense explanations** because they are based on our own sense of what is true about the world around us. Of course, scientific explanations and common sense explanations share something in common. They both start with an observation of events in the real world. However, the two types of explanations differ in the level of proof required to support the explanation. Common sense explanations tend to be accepted at face value, while scientific explanations are subjected to rigorous research scrutiny.

Scientific explanations and common sense explanations share something in common: they both start with an observation of events in the real world. However, common sense explanations tend to be accepted at face value, while scientific explanations are subjected to rigorous research.

In differentiating common sense and scientific explanations, let us examine a case of a father who sued a producer of a film because he believed that the war film had caused his son's friend to kill his son in the course of acting out a violent scene from the war film. That the film could cause a viewer to mistake reality for fantasy might seem to be a viable explanation of why the father behaved as he did. Although, this explanation may be intuitively appealing, several factors disqualify it as a scientific explanation. Rather, it is a common sense explanation because common sense explanations are not rigorously evaluated, they are likely to be incomplete, inconsistent with other evidence, lacking in generality and probably wrong. This is certainly the case with the father's ''fantasy'' explanation. Most television viewers who are addicted to

watching war films have not displayed any tendency to carry out attacks on others. Other factors must also contribute to this attack, such as aggression, etc.

Although, commonsense explanations may ‘’feel right’’ and give us a sense that we understand a behaviour, they may lack the power to apply across a variety of apparently similar situations. However, when you are looking for an explanation that transcends situation-specific variables, you often must look beyond simple commonsense explanations.

Study Session Summary

Summary

In this Study Session, you explored the concepts of scientific and common sense explanations. Commonsense explanations of behaviour is often too simplistic and situation-specific; and frequently based on hearsay, conjecture or other unreliable sources. Scientific explanations of behaviour in psychology are based on carefully made observations of behaviour; rigorously tested against alternative explanations and developed to provide the most general account that is applicable over a variety of situations. For these reasons, scientific explanation tends to be more valid and general than those provided by common sense.

Assessment

Assessment

SAQ 1.1

I. Explain why scientific explanation of behaviour is more appealing than faith or common sense approach.
II. Identify the features of scientific explanation that make it particularly useful in this regard.

SAQ 1.2

I. Highlight the similarities and differences between a common sense approach to explaining behaviour and a scientific one.
II. Analyse the inherent limitations of a common sense approach?

Bibliography

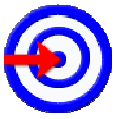
Bordens, K. S. &Abbott, B. B. (2005) *Explaining Behaviour. Research Design and Methods* 6th Edition, A process Approach 1, 5-8.

Study Session 2

Methods of Enquiry

Introduction

In this Study Session, you will be exposed to the various methods of enquiry people use to acquire knowledge about behaviour. The methods explained in this Study Session include the method of authority, the rational method, and the scientific method.



Learning Outcomes

At the end of this Study Session, you should be able to:

i. *point out* ways to acquire knowledge about behaviour.
ii. *differentiate* the available methods of acquiring knowledge about behaviour.

Before a scientist can offer valid and general explanations for behaviour, he or she must gather information about the behaviour of interest. Knowledge about behaviour can be acquired by several methods, including the method of authority, the rational method, and the scientific method.

2.1 The Method of Authority

When you use expert sources (whether books or people), you are using the method of authority. This method involves consulting some source you consider authoritative on the issue in question, for example, consulting books, television, religious leaders, or scientists. This method was useful in the early stages of acquiring knowledge; however, it does not always provide valid answers to questions about behaviour for at least two reasons. First, the source you consult may not be truly authoritative. Second, sources are often biased by a particular point of view. For instance, a sociologist may offer you a different explanation of an abnormal behaviour, from one offered by a behaviourally oriented clinical psychologist.

For these aforementioned reasons, the method of authority by itself is not adequate for producing reliable explanations. Although, this is not to say the method of authority is totally faulty in the search for explanations of behaviour; the method does play an important role in the acquisition of scientific knowledge. This is because, information you obtain from authorities on a topic can familiarize you with the problem in question, the available evidence, and the proposed explanations. With this information you could generate new ideas about causes of behaviour. However, these ideas must then be subjected to rigorous scientific scrutiny rather than being accepted at face value.

2.2 The Rational Method

The rational method of enquiry takes place when you acquire knowledge about behaviour through logical reasoning rather than authority or the evidence of one's senses. "Knowledge" acquired in this way must be approached with caution. The power of the rational method lies in logically deduced conclusions from self-evidence truths. Unfortunately, precious few self-evident truths can serve as assumptions in a logical system.

However, because of the shortcomings of the rational method, it is not used to develop scientific explanations. Though, it still plays an important role in science. The tentative ideas that you form about the relationship between variables are often deduced from logical reasoning. For example, having learned that fleeing from a fire or trying to get into a crowded arena causes irrational behaviour, one can deduce that "perceived availability of reinforces" (escaping death or getting a front-row seat) is responsible for such behaviour. Rather than accepting such a deduction as correct, however, the scientist put the deduction to empirical test.

2.3 The Scientific Method

According to Braithwaite (1953), the function of a science is to "establish general laws covering the behaviour of the empirical events with which the science in question is concerned". He further argued that a science should allow us to fuse together information concerning separately occurring events and to make reliable predictions about future, unknown events. One goal of psychology is to establish general laws of behaviour that help to explain and predict behavioural events that occur in a variety of situations.

Scientific method Principles and procedures for the systematic pursuit of knowledge involving the recognition and formulation of a problem, the collection of data through observation and experiment, and the formulation and testing of hypotheses

Although, explanations for behaviour and general laws cannot be adequately formulated by relying solely on authoritative sources and using deductive reasoning, these methods (when combined with other features) form the bases for the most powerful approach to knowledge yet developed: **the scientific method**. The scientific method comprises a series of four cyclical steps that you can repeatedly execute as you pursue the solution to a scientific problem (Yaremke, Harari, & Lynn, 1982). These steps are:

A. observing a phenomenon;
B. formulating tentative explanations or statements of cause and effect;
C. further observing or experimenting (or both) to rule out alternative explanations; and
D. refining and retesting the explanations.

2.3.1 Observing a Phenomenon

To observe the behaviour of interest is a starting point for using the scientific method. At this stage, some behaviours or events may catch your attention. These preliminary observations of behaviour and of potential causes for that behaviour can take a variety of forms. Through the process of observation, you identify variables that appear to have an

important influence on behaviour. A variable is any characteristic or quantity that can take on two or more values. In the example cited in the last Study Session, the amount of violence in a war film is a variable that can vary from very low to very high. Don't forget that in order for something to be considered a variable, it must be capable of taking in at least two values. Any characteristic or quantity that takes on only one value is known as a constant.

2.3.2 Formulating Tentative Explanations

After identifying an interesting phenomenon to study, next step is to develop one or more tentative explanations that seem consistent with your observations. This means that you tentatively state the nature of the relationship between two or more variables; that is, the relationship between variables that you expect to uncover with your research. The tentative statement you offer concerning the relationship between your variables of interest is called a hypothesis. This stated hypothesis must be testable with empirical research. For example, "a child is more likely to be aggressive after watching a war film than after watching a non-war film". Notice that the hypothesis links two variables (the war film and aggressive behaviour) by a statement indicating the expected relationship between them. In this case, the relationship expected is that watching war film will increase the likelihood of behaving aggressive by a child. Research hypotheses often take the form of a statement of how changes in the value of one variable (watching war film or non-war film) will affect the value of the other variable (aggressive behaviour).

2.3.3 Further Observing and Experimenting

Up to the point of developing a hypothesis, the scientific method does not differ markedly from other methods of acquiring knowledge. At this point, all you have done is to identify a problem to study and develop a hypothesis based on some initial observation. The scientific method, however, does not stop here. The third step in the scientific method marks the point at which the scientific method differs from other methods of inquiry. Unlike the other methods of inquiry, the scientific method demands that further observations be carried out to test the validity of any hypothesis you develop.

Making further observations is simply what the scientific method is all about. After formulating your hypothesis, you design a research study to test the relationship you proposed. In this case, you decide to design an experiment in which you systematically manipulate the amount of violence in a war film and observe whether different levels of violence in the film produce different rates of aggressive behaviour.

2.3.4 Refining and Retesting Explanations

The final step in the scientific method is the process of refinement and re-testing. For example, imagine that you found that war film increases aggressive behaviour. Having obtained this result, you would probably want to explore the phenomenon further: Would the realism of a film matter?'' A refined hypothesis might take the following form: '' Realistic

war films are more likely to result in increased aggression than unrealistic war films''.

This process of generating new, more specific, hypotheses in the light of previous result illustrates the refinement process. Often, confirming a hypothesis with a research study leads to other hypotheses that expand on the relationships discovered, explore the limits of the phenomenon under study, or explore the causes of the relationship observed.

As you become more familiar with the process of conducting research, you will find that not all research studies produce affirmative results. That is, sometimes your research does not confirm your hypothesis. What do you do then? In some cases, you might completely discard your original hypothesis. In other cases, however, you might revise and re-test your hypothesis. In the latter instance, you are using a strategy known as re-testing. Keep in mind that any revised or refined hypothesis must be tested as rigorously as was the original hypothesis.

Study Session Summary

Summary

In this session, we learnt that there are ways to acquire knowledge about behaviour which includes: method of authority or rational method. These methods are not acceptable methods for acquiring scientific knowledge.

The scientific method is the only method accepted for the acquisition of scientific knowledge. The four major steps of the scientific method are: observation of a phenomenon, formation of tentative explanations, further observation or experimentation to rule out alternative explanations (or both), and re-testing and refinement of the explanations.

Assessment

Assessment

SAQ 2.1

I. Enumerate and explain three different methods to understanding behaviour.
II. What are the limitations of the Method of Authority and Rational methods?

SAQ 2.2

I. Point out the 4 cyclical steps that should taken in a scientific method to solving a problem.
II. What is the difference between refining and retesting a hypothesis?

Bibliography

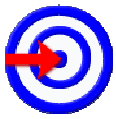
- http://allpsych.com/researchmethods/developingthehypothesis.html

Study Session3

Psychological Experimentation: an Application of the Scientific Method

Introduction

In this Study Session, you will explore the processes in the application of scientific method in psychological experimentation. These include statement of problem, hypothesis formulation, selection of participants and assigning then into groups, and types of variables.



Learning Outcomes

At the end of this Study Session, you should be able to:

i. *state* problems in research method.
ii. *formulate* hypotheses in psychological experiment.
iii. *select* and *assign* participants into groups.
iv. *establish* empirical relationships between stimuli and responses in research.
v. *control* extraneous variables.

3.1 Stating the Problem in Research

A psychological experiment starts with the formulation of a problem, which is usually best stated in the form of a question. The question must be solvable or answerable with the tools that are available to the researcher. Once you have identified the behaviour to study, you must then state a problem or a research question in ways that will allow it to be tested empirically. Beyond this, the problem may be concerned with any aspect of behaviour, whether it is judged to be important or trivial. One lesson of history is that you must not be hasty in judging the importance of the problem on which a scientific question is based.This is because many times what was momentarily discarded as trivial or irrelevant has contributed sizably later to scientific advances (McGuigan, 1997). Many students of research have trouble at this point. Students seem to have little trouble identifying interesting, broadly defined behaviours to study (for example, ‘’I want to study memory’’), but they have trouble isolating crucial variables that need to be explored.

3.2 Formulating a Hypothesis

The experimenter formulates a tentative solution to the problem in the form of a hypothesis. The hypothesis may be a reasoned potential solution or only a vague guess, but in either case; it is an empirical hypothesis, in that, it refers to observable phenomenon, i.e. stimuli and

behaviour. Following the statement of the hypothesis, the experimenter tests it to determine whether the hypothesis is (probably) true or (probably) false. If true, it solves the problem the experimenter or researcher has formulated. To test the hypothesis, you must collect data; this is because a set of data is our only criterion. Various techniques are available for data collection, but experimentation is the most powerful. We will examine hypothesis in greater details in Study Session Four.

3.3 Selecting Participants

One of the first steps in collecting data is to select participants whose behaviour is to be observed. The type of participants studied will be determined by the nature of the problem. If the concern is with psychotherapy for example, one may select a group of depressives. A problem concerned with the function of parts of the brain would entail the use of animals (few humans volunteer to serve as participants for brain operations). Whatever the type of participant, the experimenter typically assigns them to groups. For the purpose of this course, we shall consider here basic type of experiment; namely; one that involves only two groups.

Those who collaborate in an experiment for the purpose of allowing their behaviour to be studied may be referred to either as participants or by the traditional term subjects. ‘’Participants’’ is preferable and recommended in the Publication Manual of the American Psychological Association (APA, 1994). ‘’Subjects’’ is not acceptable because the term suggests that people are being used or that there is a status difference between the experimenter and the subject (as a king and his subjects).

3.3.1 Assigning Participants to Groups and Treatment

Participants should be assigned to groups in such a way that the groups will be approximately equivalent at the start of the experiment; this is accomplished through randomization. The experimenter next administers an experimental treatment to one of the groups. The experimental treatment is that which one wishes to evaluate, and it is administered to the experimental group. The other group, called the control group, usually receives a normal or standard or no treatment.

3.4 Stimulus – Response Laws

In the study of behaviour, the psychologist generally seeks to establish empirical relationships between stimuli (aspects of the external environment, the surroundings in which we live) and responses (aspects of behaviour). This stimulus-response relationship, known as S–R law, essentially state that if certain environmental characteristic is changed, behaviour of a certain type also changes.

3.4.1 Independent and Dependent Variables

The stimulus event that is experimentally studied is an ‘’independent variable’’ the measure of any change in behaviour is a “dependent variable”. A variable is anything that can change in value or amount, such as magnitude or intensity. Thus, a variable generally is anything that may

assume different numerical values. For example, the amount of pay a worker receives for performing a given task is an independent variable that can change in value. However, the performance level of the worker is an example of a dependent variable. The performance may be dependent on the amount of a pay a worker receives.

3.4.2 Continuous and Discrete Variables

Continuous variable A variable that can, within a given range, take on an infinite number of possible values.

Variable that assumes any fraction of a value (i.e. it may be represented by any point along the line in a continuum), is called a continuous variable. A **continuous variable** is one that is capable of changing by any amount, even on infinitesimally small one. Example of continuous variables include organizational commitment, job performance etc. A variable that is not continuous is called a discontinuous or discrete variable. **A discrete variable** can assume only numerical values that differ by clearly defined steps with no intermittent values possible. For example, the number of student in this class (PSY 209) would be a discrete variable; of course, one would not expect to find a part of a student in this class. Thus, one might find 1, 15, 299 or 219 students in PSY 209 class; but not 1.6, 20.6 or 299.5 students. Other examples of discrete include gender, and eye colour.

Discrete variable A variable that takes values from a finite or countable set

3.4.3 Determining the Influence of an Independent Variable

Now, with the understanding that the experimenter seeks to determine whether an independent variable affects a dependent variable (either of which may be continuous or discrete), let us relate the discussion to the concepts of experimental and control groups. To determine whether a given independent variable affects behaviour, the experimenter administers one value of it to the experimental group and a second value of it to the control group. The value administered to the experimental group is the **experimental treatment** or **experimental condition**, whereas the control group is usually given a **normal treatment** or **no treatment**. Thus, the essential difference between "experimental'' and "normal'' treatments are the specific value of the independent variable that is assigned to each group. For example, the independent variable may be the intensity of a shock (i.e. a continuous variable); the experimenter may subject the experimental group to a high-intensity and the control group to a lower intensity or zero– intensity shock.

The dependent variable is usually some well defined aspect of behaviour (a response) that the experimenter measures. The value obtained for the dependent variable is the criterion of whether the independent variable is effective, and that value is expected to be dependent on the value assigned to the independent variable. The dependent variable is also dependent on some of the extraneous variables, that would be discussed shortly, that are always present in an experiment. Thus, an experimenter varies the independent variable and notes whether the dependent variable systematically changes. If it does change in value as the independent variable is manipulated, then it may be asserted that there probably is a relationship between the two. If the dependent variable does not change,

it may be asserted that the independent variable (IV) and dependent variable (DV) are not related.

3.5 Controlling Extraneous Variables

The most important principle of experimentation is that the experimenter should try to assure that no variables other than the independent variable(s) may affect the dependent variable. It is only the independent variable(s) whose effect is being evaluated. If the experimenter allows a number of other extraneous variables to operate freely in the experimental situation, the experiment might be contaminated. For these reasons, one seeks to control the extraneous variables in an experiment. Extraneous variable contaminates an experiment and this makes the findings unacceptable.

- Independent variable is an aspect of the environment that is systematically varied such that normal value is assigned to the control group and the novel value to the experimental group.
- Dependent variable is a well-defined aspect of behaviour that is the criterion of whether the independent variable is effective.
- Extraneous variables are those variables that may operate freely to influence the dependent variable.

Extraneous variables need to be controlled to accurately assess the effect of the independent variable on the dependent variable.

Activity 3.1

Allow 20 minutes

Explore the resources in the following links

- http://www.sparknotes.com/psychology/psych101/researchmethods/section2.rhtml
- http://aspire.cosmic-ray.org/labs/scientific_method/sci_method_selector.swf
- http://www.sciencebuddies.org/science-fair-projects/project_scientific_method.shtml

Using the knowledge you have gained in this session and the information in the following resource-links, present a model / chart for scientific method as applied in psychology. Endeavour to provide brief explanation on your model.

See course calendar for schedule date of turning in response to this activity

Study Session Summary

Summary

In this Study Session, you learnt the critical steps in application of scientific method in experimentation. An experimenter first states a problem and formulates hypothesis. To test the stated hypothesis, the experimenter selects a sample of participants and randomly assigns them to either the experimental group or control group. These groups will be randomly assigned to conditions or treatments where the experimental group serves under a novel condition and the control group serves under a normal or standard condition.

Assignment

Assignment

Respond to the questions / tasks in the following links.

http://www.psywww.com/selfquiz/ch01mcq.htm

http://sciencespot.net/Media/scimethodwkst.pdf

Assessment

Assessment

SAQ 3.1

I. State the guidelines that should be followed in stating a problem in research?

SAQ 3.2

II. What are the general principles you will consider in formulating a hypothesis and testing it.

SAQ 3.3

I. Consider the research problem: The effect of studying while listening to classical music on academic performance. Amongst a group of 70 people (40 males and 30 females) how would you select and assign participants into groups.
II. Differentiate between an experimental group and a control group.

SAQ 3.4

I. Explain the logic of the Stimulus-Response Law.

SAQ 3.5

I. Identify possible effects of having extraneous variables in experimentation.

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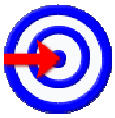
Study Session 4

Hypothesis Development and Testing

Introduction

Hypothesis, as noted in the previous Study Session, is a tentative statement relating two (or more) variables that you are interested in studying. This Study Session explains how hypothesis is developed in the research process. It will go further to expose you to how to test hypothesis, and determine whether a hypothesis is accepted or rejected.



Learning Outcomes

At the end of this Study Session, you should be able to:

i. *present* an hypothesis relating one variable to the other.
ii. *highlight* the criteria for a good hypothesis.
iii. *test* an hypothesis.

4.1 Developing an Hypothesis

Developing your hypothesis should flow logically from the sources of information used to develop your research question. In other words, given what you already know from previous research (either your own or what you read in the journals), you should be able to make a tentative statement about how your variables of interest relate to one another.

Hypothesis development is an important step in the research process because it will inform your later discussions concerning the variables to be manipulated and measured in your study. Because a poorly conceptualized research hypothesis may lead to invalid results, you have to take considerable care when stating your hypothesis.For example, imagine that your general research question centres on the relationship between aging and memory. You have spent several hours in the library using PsyINFO to find relevant research articles. You have found several articles showing that older adults show poorer memory performance on tasks such as learning nonsense syllables, learning lists of words, and recognizing pictures. However, you found very little on age differences in the ability to recall details of a complex events such as a crime.

Based on what you found about age differences in memory from your literature review, you strongly suspect that older adults will not recall the details of complex events as much as younger adults. Thus far, you have a general research question that centres on age differences in the ability to recall details of a complex event. Your next step is to translate your suspicion about the relationship between these two variables into a testable research hypothesis. You might, for example, develop the

following hypothesis: “Older adults are expected to recall fewer details of a complex event correctly than younger adults’’.

In the example above, notice that you have taken the two variables from your general research question and have linked them with a specific statement concerning the expected relationship between them. This is the essence of distilling a general research question into a testable hypothesis. Once you have developed your hypothesis your next task is to decide how to test it.

4.1.1Arriving at a Hypothesis

There are some possible general sources of hypotheses. These include the following:

I: Abstracting Similarities

In these creative phases, the scientists may survey various data, abstract certain characteristics of those data, perceive some similarities in the abstractions, and relate those similarities to formulate a hypothesis. For instance, the psychologist largely observes stimulus and response events. It is noted that some stimuli are similar to other responses. Those stimuli that are perceived as similar according to a certain characteristics belong to the same class, and similarly for the responses.

II: Forming Analogies

Abstracting characteristics from one set of data and attempting to apply them to another phenomenon seems to be a form of reasoning through analogy. Indeed, careful investigations will very likely show that all philosophic theories are developed analogues (Dubs, 1930). In support, he pointed out that John Locke’s conception of simple and complex idea was probably suggested by the theory of chemical atoms and compounds that was becoming prominent in his day.

III: Extrapolating from Previous Research

The hypotheses that you formulate are almost always dependent on the results of previous scientific inquiries. The findings from one experiment serve as stimuli to formulate new hypotheses, although results from one experiment are used to test the hypothesis, they can also suggest additional hypotheses. For example, if the result indicates that the hypothesis is false, they can possibly be used to form new hypothesis that is in accord with the experimental findings. In this case, the new hypothesis must be tested in a new experiment.

4.1.2 Formulating a Good Hypotheses

The answer probably is that you learn this skill in the same manner that you learn everything else, by practice. Some hypothesis are obviously more difficulty to formulate than others. Perhaps, the more general a hypothesis is, the more difficult it is to conceive. The important general hypotheses must await the genius to proclaim them, at which time science makes a sizeable spurt forward.

To formulate useful and valuable hypothesis a scientist needs, first, sufficient experience in the area and second the quality of genius (which

includes the characteristics of perseverance). Once hypothesis is formulated, it is tested and certainly a confirmed hypothesis is better than a disconfirmed one in that it solves a problem and thus provides some additional knowledge. But even so, some unconfirmed hypotheses are better than other confirmed hypothesis.

4.2 Determining a Good Hypothesis

The following are criteria by which to judge hypothesis. Each criterion should be read with the understanding that the one that best satisfies it is the preferred hypothesis, assuming that the hypothesis satisfies the other criteria equally well. It should also be understood that these are flexible criteria, offered tentatively. These criteria include the following:

i. *That hypothesis must be testable*.The hypothesis that is presently testable is superior to one that is only potentially testable.

ii. *That hypothesis should be ingeneral harmony* with other hypotheses in the field of investigation. Although, this is not essential, the disharmonious hypothesis usually has the lower degree of probability.

iii. *That hypothesis should beparsimonious.* If two different hypotheses are advanced to solve a given problem, the more parsimonious one is to be preferred.

iv. *That hypothesis should havelogical simplicity*. This means logical unity and comprehensiveness, not ease of comprehension. Thus, if one hypothesis can account for a problem by itself and another hypothesis can also account for the problem but requires a number of supporting hypotheses or ad-hoc assumptions, the former is to be preferred because of its greater logical simplicity.

v. *That hypothesis should answer (be relevant to) the particular problem addressed*, and not some other one.

vi. *That hypothesis should be expressed in a quantified form*, or be susceptible to convenient quantification. The hypothesis that is more highly quantified is to be preferred.

vii. *That hypothesis should have a large number of consequences* and should be general in scope. The hypothesis that yields a large number of deductions (consequences) will explain more facts that are already established and will allow more predictions about events that are as yet unstudied or un-established (some of which many be unexpected and novel). In general, the hypothesis that leads to the large number of important deductions will be the more fruitful hypothesis.

However, what happens to a hypothesis that is disconfirmed? If there is a new (i.e. potentially better) hypothesis to take its place, it can be readily discarded. But if there is no new hypothesis, then you are likely to maintain the false hypothesis, at least temporarily; for no hypothesis ever seems to be finally discarded in science unless it is replaced by a new one.

4.3 Hypothesis Testing

Hypothesis testing consists of evaluating potential explanation for the observed relationships. In this Study Session, you will understand how hypothesis is tested and what confounds it.

Testable explanation allows you to predict what relationships should and should not be observed if the explanation is correct. Hypothesis testing usually begins after you have collected enough information about the behaviour to begin developing supportable explanations.

4.3.1 Steps in Testing an Empirical Hypothesis

Let us now summarize each major step that is involved in testing an empirical hypothesis. For this Study Session, you might design a study to compare the amount of anxiety experienced by students in different departments. The following steps are to be taken.

1. *State the problem*, for example, "Is there a difference in anxiety levels among students of different departments?"
2. *State the hypothesis*. For example, "If the anxiety scores of English department and Psychology department students are measured, the Psychology department students will have the higher scores" OR Psychology department students will be higher in anxiety levels than English department students.
3. *The experiment is designed*; for example, "anxiety" is operationally defined (such as scores on the Taylor Scale of Manifest Anxiety(Taylor, 1953), then samples from each population are drawn, and so on.
4. *The null hypothesis is stated*: $\mu_1 - \mu_2 = 0$; "There is no difference in the population means of the two groups". We are conducting a two tailed test because we do not have sufficient reason to confidently predict that the psychology students would be more anxious – we just suspect from causal observation that they are.
5. *A probability value for determining whether to reject the null hypothesis is established*. For example, if $P<.05$, then the null hypothesis will be rejected; if $P>.05$, the null hypothesis will not be rejected but accepted. Unless otherwise, it is assumed that you are conducting a two-tailed test, which is more conservative.
6. *Collect the data and statistically analyze them*. Compute the value of t (for t-test) and ascertain the corresponding critical value.
7. If the means are in the direction specified by the hypothesis (if the psychology students have a higher mean score than the English students for example) and if the null hypothesis is rejected, it may be concluded that the hypothesis is confirmed. If the null hypothesis is not rejected, it may be concluded that the hypothesis is not confirmed. Or, if the null hypothesis is rejected, but the means are in the direction opposite to that predicted by the hypothesis, then the hypothesis is not confirmed.

It is particularly important to distinguish casual from co relational relationship between variables. The relationship is causal if one variable directly influences the other. The relationship is co relational if the two variables simply change values together (co-vary) and may or may not directly influence one another.

Study Session Summary

In this Study Session, you observed that hypothesis development is an important step in the research process because it will drive your later discussions concerning the variables to be manipulated and measured in your study. Arriving at a hypothesis, one may abstract similarities to form and relate a stimulus class and a response class. You may reason, perhaps by analogy and practise creating hypotheses. You may also rely heavily on findings from previous experiments to extrapolate potential answers to new problems. You learnt that criteria for good hypotheses include that they are testable, are harmonious (compatible) with other hypotheses, are parsimonious, or answer the problem addressed. Also, it is preferable that hypotheses have logical simplicity, are quantifiable and are fruitful, so that they may yield numerous consequences. You use hypotheses to guide research and economize research efforts. But be aware of coincidence, for it may lead to something of importance that was not expected in the research. However, avoid experimenter short-sightedness. You were also exposed to hypothesis testing, so as to establish / check the adequacy of proposed explanations.

Assessment

Assessment

SAQ 4.1

I. There is a claim made by an NGO that children from high-income families out-perform students from low-income students in sporting activities. How would you present this hypothesis relating the respective variables.

SAQ 4.2

I. List at least six points that should be considered in determining the quality of a good hypothesis.

SAQ 4.3

I. Develop a possible hypothesis and propose steps to test it.

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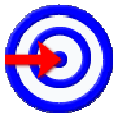
Study Session 5

Confounding Variables

Introduction

In this Study Session, you will examine confounding variables. These variables are also referred to as extraneous variables. In addition, the sources of these extraneous variables shall be explained for your comprehension.



Learning Outcomes

At the end of this Study Session, you should be able to:

i. *point out* extraneous variables.

ii. *highlight* sources of confounding variables in research.

5.1 Extraneous Variables

The presence of an extraneous variable that is systematically related to the independent variable might differentially affect the dependent variable values of the groups in the investigation. Whenever two or more variables combine in such a way that their effects cannot be separated, a confounding of those variables has occurred. Confounding; although, always a matter of concern, does not necessarily presents a serious threat to internal validity. Internal validity is the extent to which a study evaluates the intended hypotheses. Confounding is less problematic when the confounding variable is known to have little or no effect on the dependent or criterion variable or when it's known effect can be taken into account in the analysis.

Confounding variable is a variable that systematically varies along with the independent variable. For example, measuring an individual's cognitive intelligence without considering his or her age has a confounding variable. However, a study may include confounding and still maintain a fair degree of internal validity, if the effects of the confounding variable in the situation under scrutiny are known. This is fortunate, because it is often impossible to eliminate all sources of confounding by having, for example, students randomly assigned to two sections meeting simultaneously. This would certainly eliminate those sources of confounding related to any difference in the time at which the sections meet, but now it would be impossible for the teacher to teach both classes. If a second teacher is recruited to teach one of the sections using the standard method, this introduces a new source of confounding; in that the two teachers may not be equivalent in a number of ways that could affect class performance. This explained a study investigating performances of students. Often the best that can be done is to substitute

what you believe to be less serious threats to internal validity for the more serious ones.

5.2 Source of Confounding

Confounding variables or extraneous variables occur in both experimental and co-relational designs, but they are far more likely to be a problem in the latter, in which tight control over extraneous variables is usually lacking. Campbell and Stanley (1963) identified seven general sources of confounding that may affect internal validity.

1. **History** may confound studies in which multiple observations are taken over time. Specific events may occur between observations that affect the results. For example, a study of the effectiveness of an advertising campaign against drunk driving might measure the number of arrests for drunk driving at the same time that the advertisements air, this event will destroy the internal validity of your study.
2. **Maturation** refers to the effect of age or fatigue. Performance changes observed over time due to these factors may confound those due to the variables being studied. You might, for example, assess performance on a proofreading task before and after some experimental manipulation. Decreased performance on the second proofreading assessment may be due to fatigue rather than to any effect of your manipulation.
3. **Testing Effects** occur when a pre-test sensitizes participants to what you are investigating in your study. As a consequence, they may respond differently on a post-treatment measure than if no pre-test were given.For example, if you measure participants' racial attitudes and then manipulate race in an experiment on person perception, participants may respond to the treatment differently than if no such pre – test of racial attitudes was not given.
4. **Instrumentation**: Here, confounding may be introduced by unobserved changes in criteria used by observers. If observers change what counts as 'verbal aggression' when scoring behavior under two experimental conditions , any apparent difference between those conditions in verbal aggression could be due as much to the changed criterion to any effect of the independent variable. Similarly, if an instrument used to record activity of rats in a cage becomes more (or less) sensitive over time, it becomes impossible to tell whether activity really changing or just the ability of the instrument to detect activity.
5. **Statistical Regression:** threatens internal validity when participants have been selected based on extremes scores on same measure. When measured again, scores will tend to be closer to the average in the population.Thus, if students are targeted for a special reading programme based on their unusually low reading test scores, they will tend to do better, on average, on re-testing even if the reading programme has no effect.
6. **Selection Bias** threatens internal validity because subjects may differ initially in ways that affect their scores on the dependent measure. Any influence of the independent variable on scores cannot be separated from the effect of the pre-existing bias. This

problem typically arises when researchers use pre-existing groups in their studies rather than assigning subjects to groups at random. For example, the effects of a programme designed to improve worker job satisfaction might be evaluated by administering the programme to workers at one factory (experimental group) and then comparing the level of job satisfaction of those workers to that of workers at another factory where the programme was not given (control group). If workers given the job satisfaction programme indicate more satisfaction with their jobs, is it due to the programme or to pre-existing differences between the groups? There is no way to tell.

7. **Experimental Mortality** refers to the differential loss of participants from groups in a study. For example, imagine that some people drop out of a study because of frustration with the task. A group exposed to difficult conditions is more likely to lose its frustration-intolerant participants than one exposed to less difficult conditions. Any differences between the groups in performance may be due as much to the resulting difference in participants as to any difference in conditions.

Study Session Summary

Summary

In this Study Session, you learnt that confounding takes place when two or more variables combine in such a way that their effects cannot be separated. There are seven sources of confounding: history, maturation, testing effects, instrumentation, statistical regression, selection bias, and experimental mortality.

Assessment

Assessment

SAQ 5.1

I. Consider a research that suggests student's academic performance is tied to the quality of their teacher. Point out the dependent, independent and possible extraneous variables.

II. In a study of the effect of peer pressure on social behaviour of teenagers how would you classify the following variables: Religion, class seat partner, siblings, parents, social media, economic factors, classmates?

SAQ 5.2

I. In the example give in SAQ 5.1.1 above, identify potential confounding variables.

II. What are the variables that can systematically varies along with the independent variable in your research.

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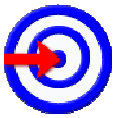
Study Session 6

Experimental Control

Introduction

This Study Session discusses the nature of experimental control which includes the independent-variables control and extraneous-variable control. Furthermore, the Study Session explains kinds of control of the independent variable, extraneous variable and techniques of control.



Learning Outcomes

At the end of this Study Session, you should be able to:

i. *describe* the nature of experimental controls.
ii. *control* the independent variables.
iii. *control* extraneous variable in research

6.1 The Nature of Experimental Control

Among the most striking advances in methodology was the recognition of the necessity for a "normal" control conditions against which to evaluate experimental treatments. The problem of controlling a variable, a critical phase in the planning and conduct of experiments, requires particular vigilance. To start, the word 'control' implies that the experimenter has a certain power over the conditions of an experiment; that power is to manipulate variables systematically in an effort to arrive at a sound empirical conclusion.

Let us illustrate by using this sophisticated, but still ancient investigation about a control condition. Athenaeus, in his 'Feasting Philosophers' describes how it was discovered that citron was an antidote for poison. It seems that a magistrate in Egypt had sentenced a group of convicted criminals to be executed by exposing them to poisonous snakes in the theatre. It was reported back to him that, though the sentence had been daily carried out and all the criminals were bitten by the poisonous snakes, none of them had died. The magistrate at once commenced an inquiry. He learned that when the criminals were being conducted into the theatre, a market woman out of pity had given them some citron to eat. The next day, on the hypothesis that it was the citron that had saved them, the magistrate had the group divided into pairs and ordered citron fed to one of a pair but not to the other. When the two were exposed to the snakes a second time, the one that had eaten the citron suffered no harm, while the other died instantly. The experiment was repeated many times and in this way (says Athenaeus) the efficacy of citron as an antidote for poison was firmly established (Jones, 1964). In such ways the logic of experimental control developed, slowly leading to our present level of methodological sophistication.

The problem of controlling variables, a critical phase in the planning and conduct of experiments requires particular vigilance. To start, the word "**control**" implies that experimenter has a certain power over the conditions of an experiment; that power is to manipulate variables systematically in an effort to arrive at a sound empirical conclusion. Let us illustrate the previous pharmacological example.

6.1.1 Independent Variable Control

First, from the illustration given above, the magistrate exercise control over his independent variable by producing the event that he wished to study. Thus, the first sense of the word 'control' is when the independent variable is varied in a known and specified manner. Here, the independent variable was the amount of citron administered, and it was purposively varied in two ways: zero and some positive amount.

6.1.2 Extraneous – Variable control

The second sense of control was when the magistrate sought to determine whether variation of amount of citron administered to the poisoned men would affect their impending state of in-animation (certainly a clear- cut dependent – variable measure, if ever there was one). To find out whether these two variables were related, however, one should ask about other (extraneous) variables that also might have affected the men's degree of viability. If there were such, the relationship that the magistrate sought might have been hidden from him. Some substance in the men's breakfast, for instance, might have been an antidote; the men might have been members of a snake cult and thereby developed an immunity; and so forth.

In the absence of knowledge of such extraneous variables, it was necessary to assume that they might have affected the dependent variable. Hence, their possible effects were controlled. The fact that only members of the group that received citron survived ruled out further consideration of the extraneous variables. Extraneous- variable control is the regulation of extraneous variables. An extraneous variable is one that operates in the research situation in addition to the independent variable. Since it might affect the dependent variable, and since we are not immediately interested in ascertaining whether it does affect the dependent variable, it should be regulated so that it will not mask the possible effect of the independent variable.

6.2 Preventing Confounding of Variable

Failure in adequately controlling extraneous variables results into a confounding experiment, a disastrous consequence for the experimenter. That is, if an extraneous variable is allowed to operate systematically in an uncontrolled manner, it and the independent variable are confounded. Consequently, the dependent variable is not free from irrelevant influences. In the illustration on citron, for example, supposed that those who received citron had been served a different breakfast than had the control participants. In this case, the magistrate would not know whether it was citron or something in the breakfast of the experimental group that

was the antidote-type of breakfast would thus have been an extraneous variable that was confounded with the independent variable.

Confounding occurs where there is an extraneous variable that is systematically related to the independent variable, and it may act on the dependent variable; hence the extraneous variable may affect the dependent variable scores of the one group, but not the other. If confounding is present, then the reason that any change occurs in the dependent variable cannot be ascribed to the independent variable.

If variation of the independent variable is systematically accompanied by variation of an extraneous variable, and if the dependent variable values for the groups differs; the reason for the difference may be because of the extraneous variable, not the independent variable.

6.2.1 Control of the Independent Variable

I have said that control of the independent variable occurs when the researcher varies the independent variable in a known and specified manner. There are two ways in which an investigator may exercise control of the independent variable:

1. Purposive variation (manipulation) of the variable,
2. Selection of the desired values of the variable from a number of values that already exist.

- When purposive manipulation is used, an experiment is being conducted, but selection is used in the method of systematic observation. If you are interested whether the intensity of a stimulus affects the rate of conditioning, you might vary intensity in two ways: high and low. Participants are randomly assigned into two groups, and randomly determine which group would receive the low-intensity stimulus, which one the high. In this case, you are purposely varying (i.e. manipulating, controlling)the independent variable (this is an experiment)
- To illustrate control of the independent variable by selection of values as they already exist (the method systematic observation), for example, consider the effect of intelligence on problem solving. By studying widely differing values of intelligence such as an average 1Q of 135, a second of 100 and a third of 65, the investigator determines what values of the variables are to be studied. However, in this case, the investigator must find certain groups that have the desired values of intelligence. To do this, one might administer intelligence tests at three different institutions. First, one might study bright college students to obtain a group with an average 1Q of 135. Second, one might choose a rather non-selective group such as high school students or army personnel for an average value of 100. Third, one might find a special institution that would yield a group with an average 1Q of 65. With these three groups constructed, a test of problem-solving ability would be administered and the appropriate conclusion reached.
  Observe that the values of the independent variable were selected from a large population.The 1Qs of the people tested determined

who would be the participants. The researcher has not, as in the experimental example, determined which participants would receive which value of the independent variable. In selection, it is thus the other way around: the value of the independent variable determines which participants will be used. It is apparent that in independent variable control by selection of values as they already exist in participants, the participants are not randomly assigned to groups- this is a critical shortcoming of the method of systematic observation.

6.2.2 Techniques of Controlling Extraneous Variable

Although experimenters try to exercise adequate experimental control, sometimes a crucial, uncontrolled extraneous variable is discovered only after the data are compiled. Errors of control may be found in the work of both young and experienced researchers. How can you control them? After an important extraneous variable is specified, how is it to be controlled? What techniques are available for regulating it so that the effects of the independent variable on the dependent variable can be clearly isolated? McGuigan (1997) illustrated the common techniques available for controlling extraneous variable as follows.

1. **Elimination:** This is simply by eliminating the extraneous variables from the experimental situation. For example, you can conduct your study in a soundproof laboratory to eliminate extraneous noises and lights. However, most extraneous variables cannot be eliminated. Other extraneous variables that one would have difficulties eliminating include age, gender intelligence.
2. **Constancy of Conditions:** Extraneous variable that cannot be eliminated might be held constant throughout the experiment. The same value of such a variable is thus present for all participants. One of the standard applications of the techniques of holding condition constant is to conduct experimental session in the same room. Procedurally, all participants should go through the same steps in the same order. The technique of constancy of conditions dictates that all participants use the same projector, recording apparatus or other equipment for example.
3. **Balancing:** When it is not feasible to hold conditions constant, the experimenter may balance out the effect of extraneous variables. Balancing may be used in two situations: [1] where one is unable to identify the extraneous variables, and [2] where they can be identified and one takes special steps to control them. Examples of balancing techniques include:
   - Balancing for unspecified extraneous variables.
   - Use of more than one control group to evaluate extraneous variable.
   - Balancing to control a known extraneous variable.
   - Balancing two extraneous variables simultaneously.
4. **Counterbalancing.** The general principle of this method isthat in repeated treatment experiments, each condition in an experiment must be presented to each participant in an equal number of times, and each condition must occur in an equal number of times at each

practice session. Furthermore, each condition must precede and follow all other conditions an equal number of times.

5. **Randomization** is a procedure that assumes that each number of a population or universe has an equal probability of being selected. If you select your participants in an unbiased manner from a population of 500students, each of those students has an equal possibility of participating in your experiment. Randomization is used as a control technique because the experimenter takes certain steps to equalize effects of extraneous variables on the different group. Randomization has two general applications:
    1. Where it is known that certain extraneous variables operate in the experimental situation, but it is not feasible to apply one of the preceding techniques of control.
    2. Where you assume that some extraneous variable will operate, but cannot specify them and therefore cannot apply the other techniques.

Hint

If it is not reasonable to explicitly control an extraneous variable, it should be determined whether its potential effect may be randomly distributed over groups. If so, it would not differentially affect the groups. If not; perhaps the possible effectiveness of an extraneous variable may be assessed by using more than one control group.

Study Session Summary

Summary

You learnt that confounding occurs when an extraneous variable is systematically related to the independent variable, and it might differentially affect the dependent–variable values of the two or more groups in the investigation. Purposive manipulation of an independent variable occurs when the investigator determines the values of the independent variable, “creates” those values, and determines which group will receive which value. Independent-variable control through selection occurs when the investigator chooses participants who already possess the desired values of the independent variables.

You also learnt that all psychological research involves extraneous variables. These are variables other than the independent variable that may also affect the dependent variable. All potential extraneous variables involved in an experiment should be specified and classified according to whether or not they will be controlled. Four techniques of control in addition to the use of randomization have been specified.

Assessment

Assessment

SAQ 6.1

I. What challenge would you expect in a procedure that involves an experimental control?

SAQ 6.2

I. Assuming the Oyo state government increases spending on education hoping this would lead to greater technological innovation in the state. What experimental controls would you advise the government to take note of? Also, how should they control the independent variables?

SAQ 6.3

I. As an investigator you are interested in understanding the relationship between the wage received by professors and their performance based on course evaluations by students. How would you control for extraneous variables in this investigation?

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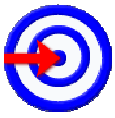
Study Session 7

Research Designs

Introduction

This Study Session will provide you a foundation from which you can engage in research designs. It will further enlighten you on some of the functions of research designs.



Learning Outcomes

When you have studied this session, you should be able to:

i. *describe* research designs.

ii. *highlight* some functions of research design.

iii. *point out* types of research design.

7.1 The Context of Research Design

Research design is a specific plan used in assigning participants to conditions, as in a two-group design or factorial design etc. The plan is systematically varying independent variables and noting consequent changes in dependent variables. This definition distinguishes the design from method of statistical analysis. Many students make the mistake of confusing research design with statistical analysis. Experimental design has also been used to include all of the steps of the experimental plan.

In a true experiment, the researcher or experimenter must conceptualize the research problem and then put it into a structural perspective or plan that will guide him in the data collection and analysis. Such plan and structure of research is referred to as the research design (Opoku, 1992). A research without a proper design is like trying to build a house without a building design or plan and a foundation (Balogun, 1999). In other words, choosing an appropriate research design is crucially important to the success of your project. The decisions you make at this stage of the research process go a long way in determining the quality of the conclusions you can draw from your research results.

7.2 Functions of a Research Design

Scientific studies tend to focus on one or the other of two major activities. The first activity consists of **exploratory data collection** and**analysis**, which aimed at classifying behaviours within a given area of research, identifying potentially important variables, and identifying relationships between those variables and the behaviour. Such exploration is typical of early stages of research in an area.

The second activity, called **hypothesis testing**, consists of evaluating potential explanations for observed relationships. Testable explanations allow you to predict what relationships should and should not be

observed if the explanation is correct. Hypothesis testing usually begins after you have collected information about the behaviour to begin developing supportable explanations.

7.3 Types of Research Design

Hint

Although there are a number of experimental designs, we shall be concentrating on few types of research designs.

7.3.1 One-Group Design

In one group design, the researcher is only interested in the influence of his experimental manipulation on the dependent variable. In this type of design, there is minimal control in the design. Therefore, you cannot be too sure that the manipulation brought about the observed change. For example, influence of job satisfaction on performance among employees. You cannot be too sure that job satisfaction causes levels of performances among the employees.

7.3.2 Two-Group /Between-Participants Experimental Design

In two groups or between-participants experimental design, there are two separate groups on which measures are taken, but it is only one of the two groups that would experience the experimental manipulation. Participants in each group are different; that is, different people serve in the control and experimental groups. The idea behind experimentation is that the researcher manipulates at least one variable (the **independent variable**) and measures at least one variable (the **dependent variable**). The independent variable has at least two groups or conditions. In other words, one of the most basic ideas behind an experiment is that there are at least two groups to compare. You typically refer to these two groups or conditions as the **control group** and **experimental group**. Experimental group is the group that receives some level of the independent variable.

7.3.3 Correlated-Groups Designs

The designs are those in which there is a relationship between the participants in each condition. There are two types of correlated-groups design: within-participants designs and matched-participants design.

Within-Participants Experimental Design

In a within-participants design, the same participants are used in all conditions. The designs are often referred to as **repeated measures designs** because you are repeatedly taking measures on the same individuals. A random sample of participants is selected, but random assignment is not relevant or necessary because all participants serve in all conditions. The within-participants designs typically require fewer participants than between-participants design. They usually require less time to conduct than between-participants design because participants can usually participate in all condition and this makes it faster. Most importantly, the designs increase statistical power. However, within-participants designs are open to some confound such as internal validity

generated from **testing effects** like multiple testing, both practice and fatigue; **carryover effects**(i.e. participants carrying "carry" something with them from one condition to another).

Matched-Participants Experimental Design

Matched-participants designs share certain characteristics with both between and within-participants designs. As in a between-participants design, different participants are used in each condition. However, for each participant in one condition, there is a participant in the other condition(s) who matches him or her on some relevant variable or variables. Matching the participants on one or more variables makes the matched-participants design similar to the within-participants design. A within-participant design has perfect matching because the same people serve in each condition; with the matched-participants design, you are attempting to achieve as much equivalence between the groups as you can. The matched-participants designs have some advantages. For instance, because there are different people in each group, testing effects and demand characteristics are minimized in matched-participants designs compared to within-participants designs.

Study Session Summary

Summary

In this session, you learnt that as a researcher, you need to consider several factors when designing and evaluating a true experiment. First, you need to address the issues of control and possible confounds. Second, you need to consider external validity in order to ensure that the study is as generalizable as possible while maintaining control. Lastly, you should use the design most appropriate for the type of research being conducted. You should consider the strengths and weaknesses of each of the types of designs when determining which would be best for their study.

Assessment

Assessment

SAQ 7.1

I. Distinguish between a research design and a statistical analysis

SAQ 7.2

I. Explain the importance of Exploratory Data Collection and Analysis in Research Design.

SAQ 7.3

I. Discuss the one-group research design highlighting its merits and demerits.
II. Point out specific features of the two-group research design.
III. Identify and rate the different forms of correlated-group designs.

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Feedback Notes on Self Assessment Questions

SAQ 1.1

I. Scientific judgement is based on facts and not subjective personal beliefs.

II. It is empirical, rational, testable, parsimonious, general, tentative and rigorously evaluated.

SAQ 1.2

I. They are similar in that they both start with an observation of events in the real world. They differ in the level of proof required to support the explanation.

II. It cannot be applied across a variety of apparently similar situations.

SAQ 2.1

I. The method of authority, the rational method, and the scientific method.

II. One, the source you consult may not be truly authoritative. Two, sources are often biased by a particular point of view.

SAQ 2.2

I. Observing a phenomenon; formulating tentative explanations or statements of cause and effect; further observing or experimenting (or both) to rule out alternative explanations; and refining and retesting the explanations.

II. Refinement is generating new, more specific, hypotheses in the light of previous result. Retesting is going through the entire process of testing data for authenticity.

SAQ 3.1

I. Investigator must ensure to identify the behaviour to be tested and state it so it can be tested empirically.

II. Students often run into the problem of identifying interesting, broadly defined behaviours to study but they have trouble isolating crucial variables that need to be explored.

SAQ 3.2

I. Empirical hypothesis refers to observable phenomenon. After one is formed the experimenter tests it to determine whether the hypothesis is true or false. If true, it solves the problem the experimenter or researcher has formulated. To test the

hypothesis, you must collect data and there are guidelines to be followed in data collection.

SAQ 3.3

I. For the purpose of this example, participants should be students taking an exam. There should be two groups one group made to study with classical music and the other without it. Also, the groups should comprise both genders.
II. The experimental group is given the actual experimental treatment that is what one wishes to evaluate. The other group, called the control group, usually receives a normal or standard or no treatment.

SAQ 3.4

I. The logic of the stimulus-response law essentially states that if certain environmental characteristic is changed, behaviour of a certain type also changes.
II. A variable is anything that can change in value or amount, such as magnitude or intensity.
III. An independent variable is the stimulus event that is experimentally studied and the measure of any change in behaviour is a dependent variable.
IV. A continuous variable is one that can take on an infinite number of possible values within a given range. A discrete variable is one that takes values from a finite or countable set.
V. Experimental treatment is one to which the experimental group is subjected to; normal treatment is one to which the control group is exposed to.

SAQ 3.5

I. Extraneous variables should be controlled by strictly isolating subjects from them as much as possible.

SAQ 4.1

I. Identify potential independent, dependent variables, and from this make a good hypothesis.

SAQ 4.2

I. Each criterion should be read with the understanding that the one that best satisfies it is the preferred hypothesis, assuming that the hypothesis satisfies the other criteria equally well.

SAQ 4.3

I. State the problem, state the hypothesis; design the experiment; state the null hypothesis; probability value for rejecting the null hypothesis is stated; collect the data and statistically analyse them; confirm or reject the hypothesis.

SAQ 5.1

I. A potential extraneous variable factor in this case would be the quality of the school itself.
II. Peer pressure is the independent variable here and student's class seatmate would be able to exert peer pressure hence it would be

an independent variable. Social media is very broad and hence is a confounding variable.

SAQ 5.2

I. Variables that can systematically vary along with the independent variable in your research are known as confounding variables.We don't know what has made up your list, but the following are source of confounding: history; maturation; testing effects; instrumentation; statistical regression; selection bias; experimental mortality.

SAQ 6.1

I. Having controls completely void of influence from any extraneous variables can be challenging.

SAQ 6.2

I. Experimental controls would include fixed variables such as quality of education, presence of certain amenities. In this case the particular amount of money put into the sector would be an independent variable.

SAQ 6.3

I. Extraneous variables would include, for instance, whether or not the student did the course evaluation in an agreeable environment, or factors such as if the students have received their grade from that professor or not

SAQ 7.1

I. Unlike statistical analysis a research design involves systematically varying independent variables and noting consequent changes in dependent variables.

SAQ 7.2

I. Exploratory data collection classifies behaviours within a given area of research, identifying potentially important variables, and identifying relationships between those variables and the behaviour.

SAQ 7.3

I. In one group design, the researcher is only interested in the influence of his experimental manipulation on the dependent variable. Hence, it is less tedious. However, in this type of design, there is minimal control in the design.

II. With two-group research design there is an experimental group for experimental testing and there is a control group for normal testing.

III. Within-participants experimental group and matched-participant experimental groups. Rating should be based on their abilities to give credible research results.

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