Quantitative research approach

Paper given at a PhD seminar

Professor Wilson Muyinda Mande

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By the end of this lecture participants should be able to do the following:

(i) To define key terms associated with quantitative research

(ii) To discuss the positivist and post positivist paradigms

Part I

Introduction

Overview of the PhD

The historical overview of the PhD degree

✓ **Higher education gained credence in middle ages, after 900 AD.**

✓ **In 1088 the first modern university was established at Bologna.**

✓ **Academic undertakings were systematised around this period borrowing mainly from Greek and Latin civilizations.**

✓**The Greeks had developed a lot of ideas in philosophy**

✓**Latin had most of Christian education.**

Academic undertakings were put into four broad categories

Divinity   - with a highest qualification being *Divinitatis Doctor* (DD)

Medicine   - with a highest qualification being *Medicinae Doctor* (MD)

Law   - with a highest qualification being *Legum Doctor* (LLD)

Philosophy - with a highest qualification being *Philosophiae Doctor* (PhD)

Three academic levels emerged. These were:

 (i) Bachelors;

(ii) Masters ;

(iii) the Doctor;

The origin of the PhD

✓ **The doctoral degree originated in 9th century schools of Muslim world.**

✓ **The first PhD was awarded in Paris in 1150.**

✓ **PhD degree gained status as highest academic honour in early 1800s.**

✓ **Friedrich Wilhelm University in Germany, was the first university to award a modern PhD i.e. for a course of study.**

✓ **The PhD spread to the United States in the 1800s. In 1900, the PhD spread to Canada and in 1917 to Great Britain.**

✓ **The term *Philosophy* is derived from two Greek words: *philos* which means earthly love (different from agape and eros) and *sophia* which means wisdom. Hence *Philosophiae doctor (PhD)***

✓ **So, *philosophy* embedded the love for wisdom or knowledge**

categories of doctorates

It is clear now that there are four categories of doctorates:

1) **Honorary doctorates - its focus is recognition of outstanding contribution**

2) **Higher doctorates – awarded in acknowledgement of exceptions academic work**

3) **Professional doctorates – focuses mainly of practice**

4) **Academic doctorates – focuses mainly on creation of academic knowledge**

PhD in the 21st century

Number of PhDs graduating in various countries

	Country	PhDs graduating	Year
1	China	125,153	2011
2	USA	67,449	2014
3	Germany	28,147	2014
4	UK	25,020	2014
5	India	24,300	2014
6	Japan	16,039	2014
7	France	13,729	2014
8	South Korea	12,931	2014
9	Australia	8,400	2014
10	Canada	7,059	2014
11	Russia	2,223	2014
12	South Africa	2060	2014
13	Kenya	369	2017
14	Uganda	106	2018

Reasons for engaging in research

a) Every society had problems and challenge which affect survival

b) So, communities, countries and the world are concerned about survival

c) To solve problems that threaten survival one needs knowledge

d) To get knowledge one had to identify the problem

e) When one identifies problems, one has to find answers / solutions

f) Hence the need for research.

g) Research therefore contributes to development.

h) Without research, there is no knowledge, without knowledge, there is no development.

Chinese example

✓ Figures indicate that in the late 1970s China produced less than 20 PhDs each year.

✓ However, it turned around and started producing PhDs.

✓ For instance, whereas in 1978 China graduated only 18 PhDs,

✓ in 2002 it conferred 14,368 PhDs,

✓ in 2005 it granted 27,677 PhDs,

✓ in 2010 about 117,000 received PhDs and

✓ in the year, 2011, about 125, 153 received PhDs.

PhDs produced in Uganda in 2018

- ✓ In Uganda in 2018 PhD were obtained as follows:
- ✓ Makerere University   71
- ✓ Nkumba University   13
- ✓ Mbarara University of Science and Technology   11
- ✓ Gulu University   05
- ✓ Uganda Christian University   03
- ✓ Uganda Management Institute   03
- ✓ Total   **106**

Part II

The Road to Knowledge

(Ontology - to - research - to - knowledge)

✓ **We reason that the difference between quantitative and qualitative research methods has been influenced by the researcher's view of ontology (reality).**

✓ **Ontology guides the research road to knowledge.**

Definition of key terms

Ontology

a) The term ontology refers to a philosophical study of the nature of being or the theory of what or reality.

b) It is a branch of metaphysics which deals with existence of entities.

c) The term ontology was first used as *ontologia* in 1606.

d) In research, ontology, is taken as study of being or nature of reality.

e) For that reason, ontology is a system of belief that reflects an interpretation.

f) So it is the researcher's view of the nature of being or reality. Ontology is associated with the topic of the research and not necessary the variable.

g) Ontology in research seeks to answer the question, "what is the reality"?

Epistemology

a) Epistemology is defined as the study of how knowledge is acquired.

b) It is a branch of philosophy which deals with sources of knowledge.

c) There are several sources of knowledge including:

(i) *intuitive knowledge* based on intuitions, faith, beliefs, etc. Human feelings plays greater role in intuitive knowledge compared to reliance on facts.

(ii) *Authoritarian knowledge* relies on information that has been obtained from books, research papers, experts, supreme powers, etc.

(iii) *Logical knowledge* which is a creation of new knowledge through the application of logical reasoning.

(iv) *Empirical knowledge* relies on objective facts that have been established and can be demonstrated. It tries to discover what is known and how it is known.

d) Epistemology answers the question "what and how do we know the reality?"

Axiology

a) The term axiology comes from two Greek words ἀξία or axia

b)   The two words meant value or worth; and another word λογία or logia.

c) Hence the English axiology meaning the study of values.

d) So this deals with the values in the sense of ethics.

e) In social research it refers to right or good social conduct.

f) It also deals with the values in the conduct of research.

Methodology

a) This is the systematic, theoretical analysis of the methods applied to a field of study.

b) It comprises the theoretical analysis of the body on methods and principles associated with a branch of knowledge.

c) In research methodology answers the question "what procedure can we use to acquire knowledge?"

d) Methodology is different from methods in that the former shows what specific sets of methods are to be used to a particular research project.

Paradigm

a) The term paradigm originated from Greek παράδειγμα

b) It meant a model or a pattern like the one Demiurge (god) used to create the cosmos.

c) In research, the term <u>paradigm</u> refers to common beliefs shared by researchers about what problems should be understood and addressed (Kuhn, 1996).

d) A research paradigm for that matter is marked by:

   (a) ontology (What reality is);

   (b) epistemology (How reality can be known);

   (c) (Which approach can be used to know something);

   (d) axiology (What values have to be observed) and

   (e) methodology (How does one go about finding out).

Paradigm	Ontology	Epistemology	Theoretical perspective	Methodology
1 **Positivism**	**There is a single reality or truth.**	**Reality can be measured and for that reason focus on reliable and valid tools to get the measure.**	**Positivism and post-positivism (this differs in that reality is cannot be fully known because of limitations of human sensory and intellectual abilities**	**(a) Survey** **(b) Experimental**
2 **Anti-positivism** (constructionist / interpretivism)	**There is no single reality or truth. Reality is created by individuals in groups.**	**Reality needs to be interpreted. It is used to discover the underlying meaning of events and activities.**	**Since reality has to be interpreted, one should use hermeneutics, phenomenology, Feminism, critical inquiry & symbolic interaction.**	**(a) Ethnography** **(b) Grounded theory** **(c) Action research** **(d) Heuristic inquiry** **(e) Phenomenological research** **(f) Discourse analysis** **(g) Feminist standpoint**
3 **Pragmatism**	**Reality is constantly renegotiated, debated, interpreted in the light of its**	**Best method is one that solves the problem.**	**Deweyan pragmatism (research through design. Focus on human experience and not abstract notion**	**(a) Mixed methods** **(b) Design based research** 19 **(c) Action research**

Table 1 paradigm differences during antiquity

Positivism (Quantitative)

a) Knowledge viewed as singular or as about universal truth (Socrates, Plato)

b) Aristotle (384 – 322 BC)

✓ He argued that knowledge comes from experience hence the Greek term *Empeirea* for experience.

✓ From *Empeirea* we have the English Empirical. Aristotle usually contended that all knowledge begins with senses. This qualifies him to be an empiricist

✓ he differed from rationalists who argued that some knowledge was innate, that is, people are born with some knowledge before they get any experience.

✓ Empiricism is akin to inductive reasoning. (Stanford, 2017)

a) Plato underlined observable or quantitative methods while Sophists focused on arguments

b) The antiquity period was the beginning of systematising the ideas about learning.

c) Aristotle was the one who systematised subjects of philosophy, mathematics, biology, zoology, chemistry, ethics, political theory, metaphysics and others.

d) He was the founder of formal logic.

e) He was a scientist and philosopher.

f) In the former category he was a positivist, and in the latter, he was an anti-positivist. For better acquisition of knowledge, Aristotle advocated a mixture hence the <u>golden mean</u>.

g) Aristotle wrote only treatises (a book on one subject only).

h) Aristotelian philosophy influenced the Christian scholasticism (1100 - 1700 AD), medieval Islamic philosophy (800-1000), renaissance (1300 - 1600), reformation (1517-1648) and enlightenment (1600 – 1700).

Table 2 The paradigm disagreements during enlightenment (1600 – 1800)

a) Francis Bacon - 1561-1626

b) He was an English philosopher, statesman, scientist, jurist, orator, and author

c) He is called the father of <u>empiricism</u>.

d) In his works he argued that scientific knowledge was to be based only on inductive reasoning and careful observation of events in nature.

e) He advanced the use of the scientific method.

a) Enlightenment (age of reason) was philosophical movement of the 18th century marked by a rejection of traditional social, religious, and political ideas and an emphasis on rationalism.

b) It stated that science and logic gave people more knowledge and understanding than tradition and religion. This was the debate.

c) Enlightenment (1620s – 1789) stressed a scientific method and reductionism. It questioned religious orthodoxy which used scholasticism, hermeneutics and phenomenology.

d) So, it was associated with scientific revolution.

e) Those who influenced Enlightenment included Bacon, Descartes, Locke and Spinoza.

f) Keys thinkers of Enlightenment included: Hume, Kant, Rousseau, Montesquieu, Adam Smith, Voltaire, Diderot, etc

- Rene Descartes argued that all phenomena can be described as complicated combinations of simple elements.
- Hobbes believed that natural elements are related by syntactical operations. So, reasoning can be reduced to complex calculations.
- Leibniz stated that the process of understanding is the process of reducing to primitives.
- Emile Durkheim is the one who promoted positivism in academic sociology.
- Positivism was strongly recognised as philosophical paradigm in the 19th century following Auguste Comte's (1798-1857) rejection of metaphysics and his assertion that only scientific knowledge could reveal the truth about reality.
- It stated that natural (empirical) sciences were the sole source of true knowledge.
- In this way positivist rejected speculative philosophy like classical German idealism.
- Positivists also rejected theoretical speculation as a means of obtaining knowledge.
- Comte introduced the term "<u>Positivism</u>".

a) In advancing a deterministic and empirical philosophy, Auguste Comte began a paradigm (model) commonly known as positivism.

b) He asserted that causes determine effects.

c) Through direct observation and measuring quantitatively it was possible to predict relationships between variables.

d) One of the weaknesses of the positivism was the advocacy of separating the researcher from what was being researched.

e) It argued that social setting, it was rather impossible for a researcher to merely observe without allowing values and interests to interfere.

f) In that argument he seemed to believe in the <u>Hawthorne Effect</u> whereby the people change their behaviour when they know they are being observed. So the best way to obtain the genuine data is by separating oneself form the research.

Part III

Positivist and post-positivist paradigms

Positivism paradigm

a) Positivism is the notion that all knowledge is based on entirely on data of experience, that the world is a world of facts, and that these facts follow the rules of pure logic and pure mathematics.

b) It is for that matter an anti-metaphysical position.

c) It adopted David Hume's philosophical ontology. That is philosophical and logic reasoning had a linkage.

d) Hume believed that reality consisted of atomistic (micro-level) and independent events.

e) Descartes advanced <u>epistemology</u> (theory of knowledge).

f) He believed that reason was the best way to generate knowledge.

g) That events are ordered and interconnected and therefore reality is ordered and deducible.

h) The positivist paradigm asserts that real events can be observed empirically and explained with logical analysis.

i) Positivist research methodology underlines micro-level experimentation.

j) Positivism influenced the scientific practice in the social sciences.

k) Positivist research methods include experiments and tests. These are intended to support the hypothesis.

l) For that matter statistics and mathematics are central to positivist research.

Post – positivism

a) Whereas positivism states that the scientific method is the only way to establish truth and objective reality, post-positivism goes a step further to hold that no matter how faithfully the scientist adheres to scientific method research, research outcomes are neither totally objective nor unquestionably certain (Crotty, 1998).

b) It can be noted that post-positivism is less strict than positivism.

c) Post-positivism is influenced by critical realism philosophy (Trochim, 2006) which was originated by Hegel and promoted by Karl Marx.

d) Positivism focuses on the theory of verification while post-positivism uses the theory of falsification. Both paradigms agree that there is a reality independent of our thinking that can studied through the scientific method.

e) **Reality cannot be known with certainty because observations are theory-based and subject to the observer's worldview or prejudices.**

f) **To gain objectivity, multiple methods have to be employed and data triangulated.**

g) **Both paradigms share a lot in common except that post-positivism provides room for the contribution of qualitative methods.**

h) **Consequently, most research approaches and practices in social sciences fall in the post-positivism category (Kawulich, 2015).**

Paradigm	Research Approach	Ontology	Axiology	Research Strategy
Positivism / Post –positivism	Deductive	Objective	Value - free	Quantitative
Interpretivism	Inductive	Subjective	Biased	Qualitative
Pragmatism	Deductive / inductive	Objective or subjective	Value –free / biased	Qualitative and / or quantitative

Deductive reasoning

Ontology

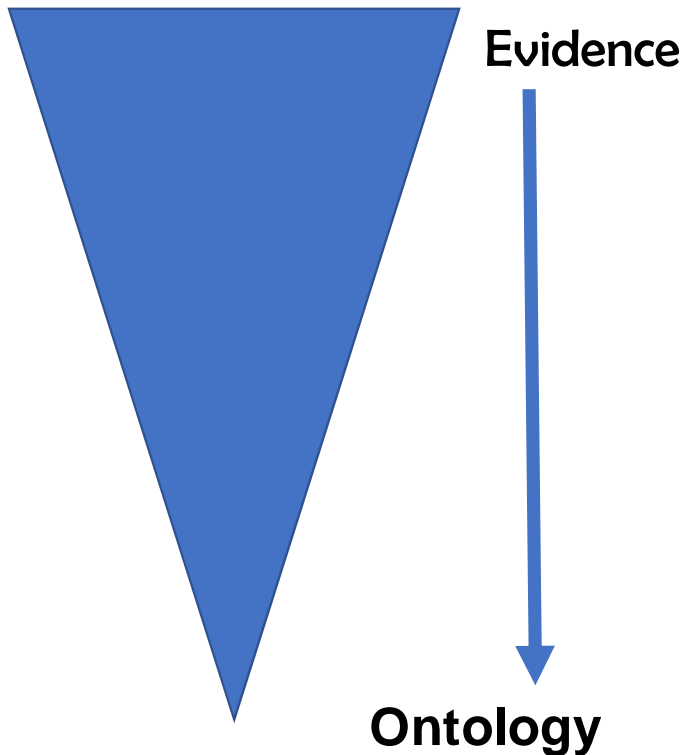**Evidence**
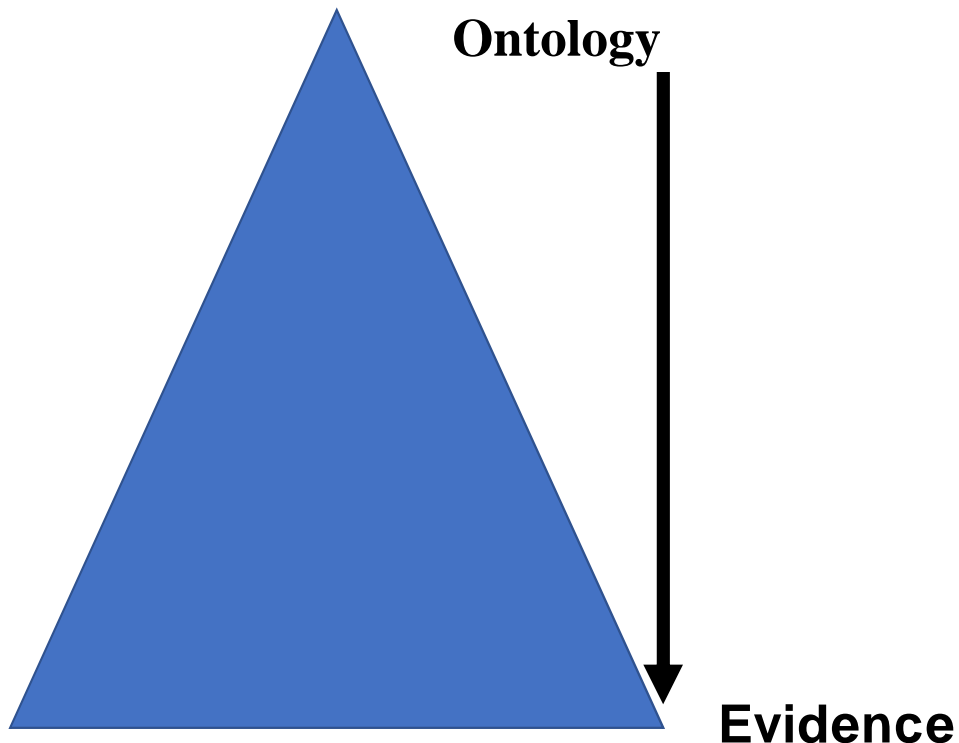
o *Reality is known and knowable.*

o *The role of the researcher is to measure, compare, etc.*

o *The researcher has to reason logically using empirical events and facts to confirm reality.*

o *Social facts have an objective reality.*

o *Variables are identified and relationships measures .*

Inductive reasoning

Inductive reasoning

Evidence

Ontology

o *Reality is socially constructed*

o *Primacy if given to the subject matter*

o *Variables are complex, interwoven and difficult to measure*

o *Emic (insider's point of view). Studies a subject in terms of its internal elements and their functioning and not in terms of any exiting external scheme*

Conceptual framework

Quantitative

The Conceptual framework leads to the formulation of hypotheses that can be empirically tested.

Quantitative framework can often, but not always, be characterised as:

i) Starting from macro (theory), rather than micro level
ii) Focused on outcomes rather than processes
iii) Positivist

Definition of research variable

<u>Why the word variable?</u>

Research exists because the world is not constant. The world is dynamic and in the process of constant change: new situations are created and everything changes with it. So phenomena vary over time and space. The fact that things can vary is the origin of the word variable.

Research is about factors that vary or factors that cause variations and the effect of those variations.

Definition of a research variable cont'd

✓A variable is a **characteristic**, **number, or quantity or an attribute that increases or decreases over time, or takes different values in different situations.**

✓**A variable is a characteristic with a variance.**

✓**Some phenomena can be measured or observed in two or more categories. These different forms or categories are called attributes.**

✓**Two basic types are:**

(1) Independent variable: that can take different values and can cause corresponding changes in other variables, and

(2) Dependent variable: that can take different values only in response to an independent variable.

- **The goal of quantitative research is to examine the relationships between variables.**
- **A variable is a characteristic or attribute of interest in the research study that can take on different values and is not constant.**
- **Variables may be straightforward and easy to measure including characteristics such as gender, weight, height, age, size, and time.**
- **Other variable may be more complex and more difficult to measure. E.g. socioeconomic status, attitudes, achievement, education level, and performance.**
- **A variable is said to have levels when it can coexist or manifest in different forms. The different forms are the levels.**

Variable is defined by two characteristics:

(i) The <u>temporal order</u> (arrangement in time). This means that one variable precedes or follows another in time. Given this ordering, one variable can be said to cause or affect another variable.

(ii) The <u>measurement characteristic</u> deals with quality of a variable. Measurement should be exhaustive and mutually exclusive. A measurement is exhaustive if all possible attributes of a variable are described.

E.g. in measuring religious affiliations, Christianity, Islam, Buddhism, Animism, are the attributes of religious affiliation. Since those may not be the only categories of religious affiliation, it is better to add "other" to make the list exhaustive.

- A variable may be mutually exclusive if no case can share two or more attributes at the same time. That is a respondent should be not be able to select two attributes at the same time.

- The two primary types of variables are **dependent and independent variables**.

- An independent variable is the variable manipulated or changed by the researcher. The independent variable affects or determines the values of dependent variable.

- The dependent variable is sometimes referred to as the outcome variable because the resulting outcome of manipulating the independent variable is typically the focus of the research study (i.e. <u>problem variable</u>).

- The dependent variable is the one that the researcher is attempting to predict or explain.

- The distinction between independent and dependent variables is especially important when studying cause-effect relationships

Other variables

Extraneous variables, also referred to as nuisance or confounding variables.

- are those factors in the research environment which may have an effect on the dependent variable(s) but which are not controlled.

- Extraneous variables are dangerous. They may damage a study's validity, making it impossible to know whether the effects were caused by the independent and moderator variables or some extraneous factor.

- If they cannot be controlled, extraneous variables must at least be taken into consideration when interpreting results.

- They are not of primary interest but related to independent or dependent variables and may affect the results.

- Researchers should control extraneous variables in order to attain meaningful results.
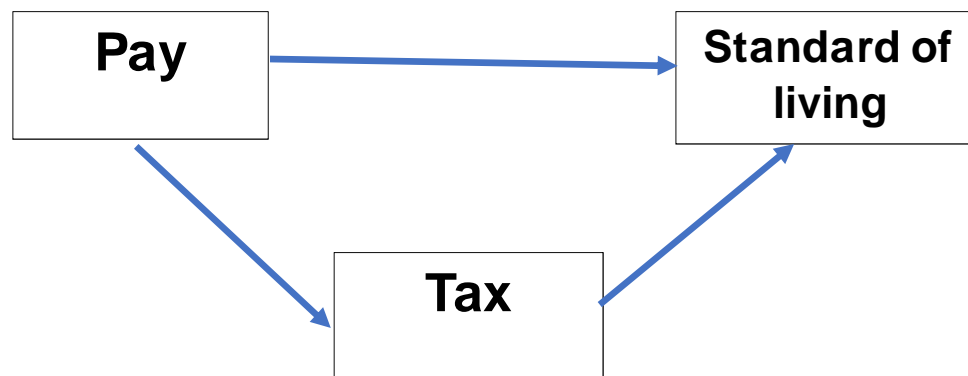
A **moderator variable** is a variable that interacts with the independent variable and may influence the strength of the relationship between the independent and dependent variables.

- This variable is measured and taken into consideration, making it different than an extraneous variable.

- It modifies the original relationship between IV and DV.

- For example, the relationship between exercise and weight loss, the number of calories consumed maybe a moderating variable.

Independent
Exercise

Dependent
Weight loss

Moderator
Calories consumed
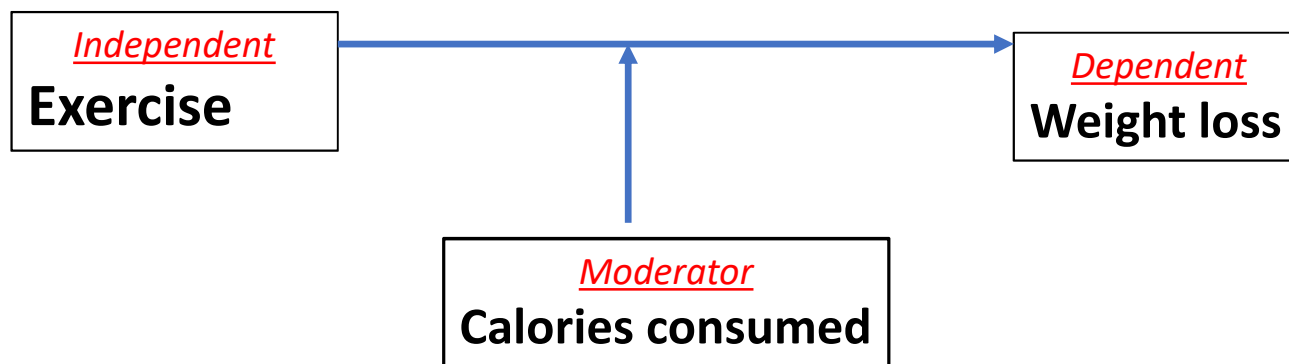
Mediating variables, commonly referred to as intervening variables, links the independent and dependent variables.

- The differing levels at which students in the class are able to process abstract mathematical concepts is a mediating variable.
- This is the variable the researcher controls.
- mediating variable also explains the dependent or outcome variable.
- Dependent variable is one observed based on the changes in the independent

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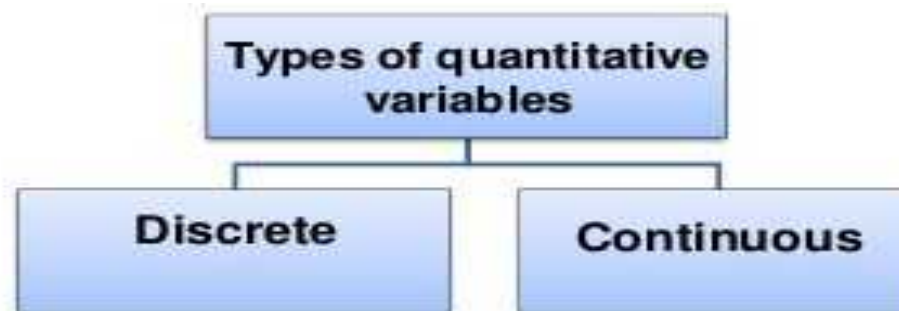
Continuous and Discrete variables

- A continuous variable is one with unlimited number of values between two points.

- Or a variable whose values can vary along a continuum.

- E.g. Between 1 and 9. It is possible to have 1.1, 1.2, 1.25, 2.22, etc.

- This requires to be restricted to a particular values

Discrete variable

This is also a categorical variable and can assume only definitive whole numbers, and fraction between two points.

For instance between 2 and 4 people, there can be only value, that is, 3.

 There cannot be 2.5 of a person.

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│  Types of quantitative  │
│        variables        │
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│ Discrete │  │Continuous│
└──────────┘  └──────────┘
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A discrete variable

is characterized by gaps or interruptions in the values that it can assume.

For example:

- The number of daily admissions to a general hospital,
- The number of decayed, missing or filled teeth per child in an elementary school.

A continuous variable

can assume any value within a specified relevant interval of values assumed by the variable.

For example:

- Height,
- weight,
- skull circumference.

No matter how close together the observed heights of two people, we can find another person whose height falls somewhere in between.

- Use the confidence level of 95%. This means that the researcher will be 95% certain of the results. One of the common formula is:

$$p\,\% \; \times \; q\,\% \; \times \; \left(\frac{z}{e} \right)^2$$

$$75\,\% \; \times \; 25\,\% \; \times \; \left(\frac{1.96}{5} \right)^2$$

$$1875 \; \times \; 0.392^{\,2}$$

$$1875 \; \times \; 0.153664$$

$$288.12$$

- So 288 is the minimum sample.

The 288 has to be adjusted to the total population of 2000 first year students.
The formula is:

$$s = \frac{n}{1 + \left(\dfrac{n}{N}\right)}$$

$$s = \frac{288}{1 + \left(\dfrac{288}{2000}\right)}$$

$$s = \frac{288}{1 + 0.144}$$

$$s = 253$$

The needed sample is therefore 253.

The above sampling techniques are best used in quantitative researches.

Sampling techniques (for minimum sample)

✓Sampling is about deciding how many people or objectives are to be included in your study. A sample is portion of the total population that is to be studied.

✓There are several ways of arriving at an acceptable sample:

(i)   Rule of the thumb – Roscoe in 1975 recommended that in social sciences any sample between 30 and 500 would give credible results.

(ii) Krejcie and Morgan – these computed samples sizes which researchers can use without calculating sample.

(iii) Confidential level – this refers to the percentage of all possible samples that can be expected to include the true population parameters.

For instance if the first year students are 2000. This is number is rather big. It is difficult to have all of them complete your questionnaire.

So determine a representative sample, the researcher needs to follow these steps:

Research design

- Research design is an overall strategy that brings together the researcher's plans of collecting data, measurements, and analysis.

i. Case study

ii. <u>Survey</u>

iii. Experimental

iv. Longitudinal

v. Documentary review

Others are:

a) Ethnographic study

b) Grounded theory

Researchers have decide which design they are to use. Choice should be connected to the way data would be interpreted.

Methods and tools of data collection

Research Method	Tool	Type of data generated
Survey	Questionnaire	Quantitative
Interview	Interview guide	Qualitative
Focus Group Discussion	FGD plan	Qualitative
Documentary review	Primary and secondary documents	Qualitative / quantitative

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Quality of research tools

(i) First the validity the items on the questionnaire should be tested. Although there are many ways of testing validity, Content Validity Index (CVI) is the most popular:

(ii) Formula: $$CVI = \frac{VR + R}{VR + R + SR + NR}$$

(iii) It is normally held that the acceptable CVI should be above 0.5

It meant that the items were suitable for the research in that each would solicit the right response from the respondents.

Reliability

✓In simple terms reliability refers to whether the items in each section focus on the variable they are intended to focus on.

✓There are various ways of testing reliability but one of the popular method is the use of the Cronbach Alpha for each section.

✓Using SPSS the results should be high enough to be reliable.

Examples of a questionnaire

Section A   **Personal variables / demographic characteristics**

Please tick (Ð) the alternative that best describes you.

1. Gender   1. Female   ____ 2. Male _____ *(nominal scale)*

 2. Age   1. Between 19 and 24 years ____   2. Between 25 and 30 years ____

                3. Between 31 and 36 years ____   4. Between 37 and above   ____

                (ordinal scale)

3. Year of study   1. First year ____   2. Second year ___   3. Third year ____

                4. Fourth year ___ 5. Fifth year ____ *(ordinal scale)*

4. Programme: 1. B.Ed _____   2. BBA_____   3. B PAM _____ 4. BIT_____

                (nominal scale)

5. Nationality 1. Ugandan _____   2. International ____ *(Nominal scale)*

Section B   Concept of quality education

Please tick (√) the alternative that best describes your views on each statement.

1. Strongly Disagree 2. Disagree 3. Not decided 4. Agree 5. Strongly Agree	1	2	3	4	5
4 Quality education is where students master communication skills					
5 Quality education is where students obtain relevant knowledge in their subjects					
6 Quality education is leads to students being competent in professional areas					
7 Quality education is one that promotes learners' rights					
8 Quality education is one that promotes the rights of the lecturers					
9 Quality education is enables learners to develop broader views on many issues					
10 Quality education is one that imparts values in learners					
11 Quality education is where a student is facilitated to learn on her own					

Section C   Determiners of quality education

Please tick (ð) the alternative that best describes your views on each statement. Use the following scale:

1. To no extent, 2. To a very small extent, 3. To a small extent, 4. To a great extent, 5. A very great extent	1	2	3	4	5
12 Quality education is decided by students					
13 Quality education is decided by lecturers					
14 The quality education is decided by external examiners					
15 The quality education is decided by internal examiners					
16 Quality education is decided by potential employers					
17 Quality education is determined by comparing institutions					
18 Quality education is determined by researchers					
19 Quality education is decided by government					

Quantitative data analysis

Data analysis is the process of systematically:

1) Analysis should seek to achieve the study objectives

2) The statistics should be supported by the figures and facts obtained qualitatively

3) For quantitative data, Chi square = relationships; correlations = direction of the relationships; Simple linear regression = causes or effects; t-test and ANOVA = variations or differences.

4) The statistics must be reported in a particular style e.g. SPSS style:

✓ Mean and Standard Deviation (M =4, SD = .091)

✓ Correlation r (230) = .345, p<0.01

✓ Regression β = .345, p<0.01

Research protocol (convention)

Research protocol (i.e. procedures, rules, conventions)	Quantitative a) Data usually recorded in structured questionnaires b) Extended use of pre-coded, close –ended questions c) Standard protocol must be followed consistently throughout the study.

Data collection

Data collection and recording methods	Quantitative
	a) Mainly numerical values (integer variables) or close-ended (ordinal or nominal) variables which can be subjected to statistical analysis. b) Some open-ended may be included c) Observational check list with clearly defined categories may be used.

Part VI

Data analysis

Data analysis procedure	For quantitative data
Preparing data	Coding data and assigning numeric values; recording data, to prepare computer analysis
Reviewing and exploring data	Descriptive analysis; looking for trends and distributions
Analyzing data	Using appropriate statistical tests; use of statistical software; recording of confidence intervals
Representing data	Representing results in tables, graphs and figures

Analysis and interpretation of results (Examples)

i.   Relationships use Correlations

Thank you

End