



Ministry of Education  
REPUBLIC OF GHANA



# GHANA SECONDARY EDUCATION IMPROVEMENT PROGRAMME - RESEARCH AGENDA

## Capacity Building in Research Methods and Statistics for MOE/GES officers

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# Outline of Course

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- **INTRODUCTION TO RESEARCH –**
  - The nature of research (inquiry)
  - Philosophical considerations
  - Planning a research
    - Framework for planning a research
    - Sampling (sample size, sampling error, the representativeness of sample, sampling strategies)
  - Ethics in research

# The Nature of Research

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- Research is the search for the truth
- People have always wanted to understand their environment and the nature of phenomena
- The means by which we can achieve these ends or acquiring knowledge include;
  1. Experience (e.g. superstition, intuition, authority, tenacity, empiricism)
  2. Reasoning (e.g. rationalism, inductive, deductive)
  3. Scientific method or research (i.e., experience/empiricism + reasoning)
- The approaches are not mutually exclusive; they are complementary and overlaps in the search for the truth.

# The Nature of Research

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## The Scientific method/Research

- Systematic, controlled, empirical and critical investigation of hypothetical propositions
- Science method/research has four characteristics
  1. It is not haphazard; it is systematic and controlled.
  2. Involves empirical observation or turns to experiences for validation
  3. Self-correcting and verifiable; the results and procedure is open to public scrutiny by fellow professionals
  4. Investigates empirically solvable problems; if problem cannot be solved using empirical techniques, the scientific method/research is not interested

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# The Nature of Research

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## Goals of the Scientific method/Research (social science)

- Description – describe pattern of behaviour, thought, feeling etc.
  - Example, you are interested in the study habit of boy and girls
  - Questions include what?, to what extent?, what is the relationship?, how? etc.
- Prediction – forecast or identify factors or conditions that indicate when event(s) will occur.
  - Question include under what condition will, what factors determines or predicts? To what extent is variable A predict variable B?
- Explanation – provide detail or in depth or reasons for the occurrence of events or phenomena.
  - Questions include why?, what accounts for? How?

# Philosophical Considerations

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## Two conceptions of social reality

- Views and interpretation of phenomena, empiricism and reality are constructed and represented differently in social science.
- The conception and methodology is broadly underlined by some implicit & explicit assumptions: ontology, epistemology and nature of human being

### 1. Ontological assumption

- Assumptions about the very nature or essence of the phenomena being investigated
- Is social reality external to individuals (i.e. objective) or the product of our consciousness (mind) (i.e., subjective)?

# Philosophical Considerations

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## 2. Epistemological assumption

- Assumptions about the very bases of knowledge – its nature and forms, how it can be acquired and shared among human beings.

**Epistemology** → **Theoretical perspective** → **Methodology** → **Methods**

- How one aligns themselves with this assumption affects how they go about uncovering knowledge.
  - Is knowledge hard, objective & tangible? Then observable role is required.
  - Is knowledge personal, subjective and unique? Then involvement with the subject is required
  - To subscribe to the former is to be positivist; to the latter, anti-positivist/interpretivism.

**Objectivism** → **Positivism** → **Survey Research** → **Statistical Analysis**

**Constructivism** → **Interactionism** → **Ethnography** → **Participant Observation**

# Philosophical Considerations

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## 3. Nature of human assumption

- Assumption about the relationship between human being and their environment
  - Are human being mechanistic and deterministic to their environment?
  - Are human beings initiators of their own actions with free will and creativity, producing their own environment?
- This assumption gave rise to determinism (events have cause(s)) and voluntarism (Burrell and Morgan, 1979)
- ***The three sets of assumptions have direct implication for methodology adopted in a study.***

# Research Philosophies

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## Positivism

- Upholds that all genuine knowledge are based on sense experience and can be advanced through observation and experiment.
- Limits enquiry to what can firmly be established and follows the empiricist and natural science tradition
- Quantification - precision of measurement allows more adequate analysis of phenomena by mathematical means
- Uses a range of traditional options such surveys, experiments, and the like

# Research Philosophies

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## Criticisms of Positivism

- Mechanistic and reductionistic view of nature by defining life in measurable terms rather than inner experience
- It excludes notions of choice, freedom, individuality and moral responsibility
- It retards increase of awareness and degree of consciousness
- It is bias as it ignores important quality
- It relies heavily on scientific knowledge neglecting aesthetics, moral, creative and other forms of knowledge

# Research Philosophies

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## Alternative to Positivism (Anti-positivism/interpretivism)

- Variety of schools of thought but united in rejecting belief that human beings are govern by general universal laws.
- The alternatives are naturalistic, qualitative, interpretive approaches.
- Social world can best be understood only from the standpoint of the individuals who are part of the ongoing action being investigated.
- Social science is a subjective rather than objective undertaking, demystify social realities through the eyes of different participants not researcher.
  - People are deliberate and creative, act internally and make meanings in and through their activities
  - Situations are fluid and changing and not fixed; thus multiply interpretations exists
  - Individuals are unique and non-generalizable
  - Social world should be studies in it natural state, no interventions and manipulations by researcher

## Difference between Positivism and Anti-Positivism

Positivism	Anti-positivism
Conventionally referred to as normative paradigm/model	Conventionally referred to as interpretive paradigm/model
Concerns with concepts of behaviour	Concerns with concepts of action (i.e., behaviour with meaning)
See theory as generated from basic reality external to the actor and manifests in society	See theory as emergent or grounded in data generated

# Research Philosophies

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## Criticisms Anti-positivism

- Proponents have gone too far in abandoning scientific procedures of verification
- Lost hope discovering useful generalization about behaviour
- Methodology: Faced with danger for favouring methods that are more akin to literature, biography and journalism.
- Subjective report may be incomplete and misleading

## Emerging approaches: Mixed methods

- Blends the two philosophies in one investigation

# Planning A Research

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- **Research** is a process of steps used to collect and analyze information to increase knowledge and understanding of a problem, and sometimes solve the problem
- The steps include
  - Posing question(s)/hypothesis
  - Collect data to answer question(s)/hypothesis
  - Present answer(s) to the question(s)/hypothesis
- It is a scientific inquiry for learning facts, testing ideas etc.
- It informs policy debates and improves practice

# Planning A Research

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- The planning of educational research is not an arbitrary matter
- Research must be conducted rigorously, scrupulously and in an ethically defensible manner
- Ethical issues or acceptable are very vital
- The parameters of a research need to be considered and made explicit
  - Research design
  - Sampling
  - Reliability
  - Validity etc.

# Planning A Research

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## A framework for planning research

- How do you operationalized a study? How can a general set of research aims and purpose be translated into practical, researchable topic?
- You need **planning** on the outset

## Research Design

- Is the overall strategy to integrate the component of the study in a coherent manner.
- Research is govern by “fitness for purpose”
  - E.g., if the purpose is to map the field or make generalization = **SURVEY** approach
  - If effects of specific interventions are to be evaluated = **EXPERIMENT/ACTION RESEARCH**
  - if in-depth study of a situation or group is desired = **ETHNOGRAPHIC** approach

# Planning A Research

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## Survey design

- Used for study that sets out to describe and interpret phenomena
- Mostly uses large population and may seek to make generalizable conclusions

## Types of survey

- Cross-sectional – data gathered and analysed on one-shot basis
- Longitudinal – data collected and analysed over a period of time
  - Cohort – select different participants from same cohort (population) over time
  - Panel – select same participants from same cohort (population) over time
- Trend – factors or variable are gathered and analysed over a period of time

# Planning A Research

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## Experiment design

- Use for study sets out to determine effectiveness, impact, effect of actions of interventions
- Ideal for the task of **causal** analysis
- Characterized by **pre-test (O<sub>1</sub>)** situation, **treatment (X)** situation and **post-test (O<sub>2</sub>)** situation.
- Establishing suitable **control** is key to experiments
  - determining that changes can be attribute to only the treatment

## Types of Experiment

- Random assignment = true/pure experiment
- Non-random assignment = quasi experiment

# Planning A Research

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## **Ethnography/Phenomenology/ qualitative design**

- Used to understand structure of experiences and consciousness from first person point of view.
- Study structures of various types of experience from perception, thought memory, imagination, desire, social activities etc.
- Literally address the meaning of phenomena in depth and expansively using relatively fewer subjects and through interviews.

## **Mixed method design**

- Use both quantitative and qualitative approaches in one study
- Seeks to ameliorate the weaknesses in both quantitative and qualitative approaches
- Types includes sequential designs, concurrent designs, convergent design, embedded design etc.

# Planning A Research

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## Sample and Sampling

- Questions of sampling arise directly out of the issue of defining the population
- **Population** – total number of people with common desirable characteristics
- **Sample** – a subset or smaller group of the total population
- Sample or sample size are not selected arbitrarily
  - Guided by some sampling procedure/mathematical formula or frame
  - Reflects the population (representativeness)
  - Access to the sample
  - Style/design of the research

# Planning A Research

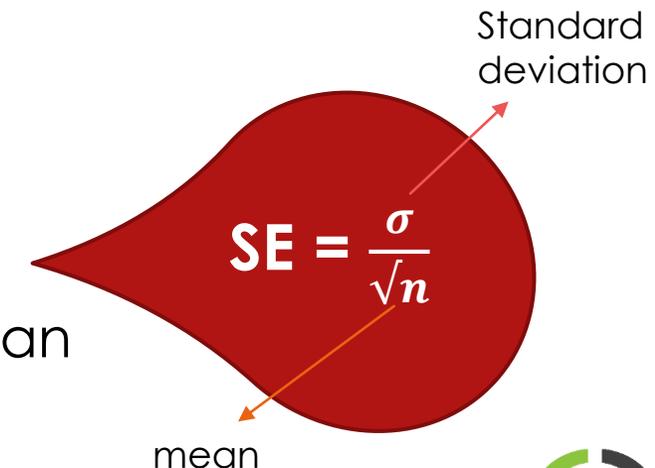
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## Sampling Error

- Arises because samples taken from sample population may not have identical characteristics to each other or the population (i.e., different means).
- Sampling error is the difference between the sample mean and the population mean
- Not necessarily the results of mistakes made in the sampling procedure, rather variation that occur due to chance selection of different individuals.

## Standard Error (SE)

- How accurate do I want results (statistical power)?
- SE tells how far the sample mean is far from the population mean



# Planning A Research

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## Sampling Techniques

- Two main sampling methods – probability and non probability sampling
- In probability samples – the chances of participants being selected are known and equal for all members of wider population
  - Seeks to represent wider population
- In non probability sample – the chances of being participants selected are unknown and biased.
  - Seeks to represent particular group, section of people.

## Probability sampling techniques

- **Simple random sampling** – equal chance of selection and probability of selection is unaffected by the selection of others.

# Planning A Research

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## Simple random sampling (cont.)

- The lottery technique is an example
- Because of probability and chance, the sample should contain subjects with characteristics similar to the population
- **Systematic sampling** – involves selecting participants in a systematic rather than a random manner, mostly from a list (sample frame).
- E.g., from a population of 2000, and a sample of 100 required, then every 20<sup>th</sup> person can be select from the list
- Select a sample interval (f):  $f = \frac{N}{n}$ , N is population and n=sample required
- Names of members of the population is listed in a random order.

# Planning A Research

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- **Stratified sampling** – used population has homogeneous sub-groups called strata (e.g., male and female, zone A, B and C etc.)
- Most used to obtain sample that is representative and proportional to the sub-groups.
- It follows a stage process: (1) divide the population into strata and (2) sampling selecting sample base on proportion or researcher's judgement
  
- **Cluster sampling** – used when population is large and widely spread.
- Puts the population into groups of homogeneous characteristics (clusters), then simple random sample of cluster is selected.
- It could be one-stage (all elements of cluster are selected) or two-stage sampling (subset of elements with selected clusters are randomly selected)

# Planning A Research

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- **Multi-stage sampling** – involves selecting sample in stages (i.e. taking sample from samples).
- Using a large nationwide study as illustration
  - Stage one: put regions of Ghana into zone and randomly sample of zone as desired
  - Stage two: identify district within select zone and randomly selected sample of districts
  - Stage three: identify SHSs in selects districts and randomly select sample of schools
  - Stage four: randomly select **math and science teachers** form selected schools.
- **Multi-phase sampling** – similar to multi-stage but in multi-phase sampling in each phase is based on different purpose (e.g. location, economic status, political affiliation).

# Planning A Research

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## Non probability sampling techniques

- **Convenience (accidental) sampling** – involves choosing the nearest individual or selecting participants who are readily available.
- E.g., standing by the roadside to distribute questionnaires, captive audience or distribution of questionnaire in the classroom
- **Quota sampling** – the nonprobability equivalent of stratified sampling
- Unlike stratified sampling it sets out to represent strata in the proportions (quota) in which they can be found in the wider population
- **Step 1:** identify the strata
- **Step 2:** identify the quota in which the selected strata appear in the population
- **Step 3:** calculate sizes of the various categories in the sample according to given quotas

# Planning A Research

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- **Purposive sampling** – researcher handpicks the participants on the basis of their judgement or assumption that the participant could be key informant
- The sample is mostly select for a specific purpose, hence the name.
- E.g., a group of principal and senior managers sample for study on leadership, one class of student selected for study on curricular activities etc.
  
- **Snowball sampling** - a small number of individuals who have the characteristics of interest are identified and they make referrals to other members of interest.
- This method is useful for sampling a population where access is difficult
- Used on sensitive topic (e.g. teenage solvent abusers) or when potential participants undertook some training or education programme together.

# Ethics in Human Research

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- Focuses mostly on the subjects, subjects matter, and methodology of research
- Ethical issues in research seeks to strengthen validity and reliability of research activities

## Responsibilities to participants or subjects

1. Respect for any person (including themselves) –
  - Individuals should be treated fairly, sensitively, with dignity and freedom from prejudice
  - Respect implies
    1. Transparency – open and honest, avoid non-disclosure (except consistent with research design and must be justified), specify details (what, why, use of data and sharing, benefits, harm etc.) about the study to participants, institutions and/or settings
    2. Consent – voluntary informed consent & participation and withdraw at any point in time (use of **consent form**).

# Ethics in Human Research

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3. Privacy and data storage - Anonymity, confidentiality of subject, context (sometimes methodology or participatory method) and/or data of physical, mental, personal social value
  4. Disclosure – only after careful considerations and consultations and under illegal circumstances such as abuse, terrorism, threatens safety.
- **Responsibilities To Sponsors, Clients, And Stakeholders**
    - Transparency – the purpose of the study, research methods used, access to data or participants, ownership of data, researchers' right to publish.
    - Acknowledge sponsors and participants of the study in any publication and dissemination activities
    - Method: Justify the extent of robustness of data collection and analysis techniques and inference drawn from findings

# Ethics in Human Research

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- **Responsibilities To the community of researchers**
  - Integrity – protect reliability, integrity and reputation of the research (including quality of evidence supporting any inferences) following the highest standards.
  - Not criticize peers in defamatory or unprofessional manner
  - Transparency and data amenability – endeavor to make data amenable to scrutiny when need arise
  - Observing and reporting findings accurately and all details (favourable and unfavourable)
  - Avoid plagiarism
  - Proper attribution or referencing

# Ethics in Human Research

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- **Responsibilities To publication and dissemination**
  - Communicate findings and practical significance in clear, straightforward fashion and language
  - Provide open access (without a paywall)
  - Researchers must not bring research into disrepute by in any way falsifying, distorting, suppressing, selectively reporting

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**THANK YOU FOR YOUR ATTENTION & TIME**

