



Approaches in Medical Education Research

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Overview

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- Sections of this presentation
 - An overview of the scientific method and educational research
 - The classification of types of research by purpose
 - The classification of types of research by method

Introduction

3

- Advances in understanding and practice of medical education
- Adding reliable new knowledge to produce “best evidence”
- Help educators to make better decisions : teaching & learning, curriculum & assessment,...
- There is often little interest by clinicians in medical education research, possibly as a result of a lack of training in education research methods

Aim

4

- The purpose of this session is to provide medical educators, especially those who are new to medical education research, with a basic understanding of how quantitative and qualitative methods contribute to the medical education evidence base through their different inquiry approaches.

What is education research?

5

- The application of the scientific method to study *educational problems*
- The *goal is to explain, predict, and/or control educational phenomena*

What is medical education research?

6

- ‘... investigation or experimentation aimed at the discovery and interpretation of facts, revision of accepted theories or laws in the light of new facts, or practical application of such new or revised theories or laws’.
- To gain new knowledge that can then be added to a body of existing knowledge in order to develop new insights and create more useful knowledge to solve a problem
- Medical education research is a careful or systematic study designed to answer the fundamental questions raised by medical educators in order to make educational decisions that can be based on rigorous research-based findings rather than personal experiences.

Educational Research

7

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- Steps for conducting educational research
 - Selection of a problem
 - Use of specific research procedures to design and collect data
 - Analysis of data
 - Statement of conclusions based on the results of the data analyses
 - Parallels the steps in the scientific method

Educational Research

8

- Difficulties conducting educational research
 - Involves human beings and the complexities associated with them
 - Difficulties generalizing from specific studies
 - Problems when imposing sufficient controls to conduct research in educational settings
 - Complications when observing in educational settings
 - Indirect measurement of the variables being studied

Classifying Research

9

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- Two helpful ways to view research
 - Purpose
 - *The degree of direct applicability of research to educational practices and settings*
 - Method
 - *The overall strategies followed to collect and analyze data*

Research Categories

10

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- Five categories
 - Basic
 - Applied
 - Evaluation
 - Research and development (R & D)
 - Action

The Purposes of Research

11

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- Basic research
 - Collection and analysis of data to develop or enhance theory
 - Examples related to **learning theory**
 - *Constructivism*
 - *Mastery learning*

The Purposes of Research

12

■ Applied research

- Collection and analysis of data to examine the usefulness of theory in solving practical educational problems
- Examples
 - *Developing a curriculum around a problem-solving approach to learning*
 - *Examining the effectiveness of a computer-based program developed around a mastery learning approach*

The Purposes of Research

13

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- The interaction of basic and applied research
 - Basic research provides the theory that produces the concepts for solving educational problems
 - Applied research provides the data to help support, guide, and revise the development theory

The Purposes of Research

14

- Evaluation research

- The collection and analysis of data to make decisions related to the merit or worth of a specific program

- *Merit relates to a program accomplishing what it was supposed to accomplish*

- *Worth relates to the value attached to a program by those using it*

The Purposes of Research

15

- Evaluation research

- Types of evaluation

- *Formative evaluation is designed to inform and improve a program while it is being developed or implemented*
 - *Summative evaluation is designed to make decisions regarding the overall quality of the program being evaluated*

The Purposes of Research

16

- Research and development
 - The development of effective products for use in class/hospital,...
 - Examples
 - *The development of the software to create a computerized program that incorporates an individualized mastery learning approach to teaching basic concepts in specific subject*
 - *The development of a Smart Board to enhance a teacher's use of technology in the classroom*

The Purposes of Research

17

- Action research
 - The collection and analysis of data to provide a practical solution to the problems
 - Examples
 - *How can our college move to a performance based model for undergraduate programs?*
 - *How can disciplinary policies be enforced in our department?*

Research Methods

18

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- Two general categories of methods currently being used in educational research:
 - Quantitative
 - Qualitative

Understanding of the knowledge construction process-Paradigms

- A paradigm is a comprehensive belief system or a worldview that provides a general perspective or framework to guide an understanding of the phenomenon under investigation.
- The paradigms respond to three questions:
 - (a) What is the nature of reality (known as ontology)?
 - (b) What is the nature of knowledge, its limitations and its relationship to the researcher (known as epistemology)?
 - (c) How should the researcher go about finding out knowledge (known as methodology)

Paradigms

20

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- Two main paradigms that guide disciplined inquiry in medical education, the positivist paradigm and the naturalistic paradigm.

The positivist paradigm

21

- Positivists believe that objective collection of data and its analysis must be independent of the opinions of the researcher.
- ...a hypothesis is derived from a theory and then empirically tested and replicated by a neutral researcher. Based on the result of a statistical hypothesis test, the researcher identifies the relationship between cause and effect within a value-free inquiry.

The naturalistic paradigm

22

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- Known as constructivism, and is associated with qualitative inquiry approaches.
 - Individuals do not passively receive knowledge, but they actively construct knowledge through engagement with each other and the social world they are living in.
 - Meaning making activity of an individual's mind

Inductive and deductive approaches

23

- Knowledge is created, based on either the inductive or deductive approach.
- Qualitative researchers use the inductive approach (a bottom-up method of analysis) to generate knowledge whereas quantitative researchers use the deductive approach (formulating a research hypothesis) to generate knowledge.
- Both approaches are important for generating knowledge and the choice is based on the question being investigated.

The role of theory in education research

24

- A theory is ‘a set of interrelated constructs (concepts), definitions, and propositions that present a systematic view of phenomena by specifying relations among variables, with the purpose of explaining and predicting the phenomena’.
- In quantitative studies, theory-driven investigations are essential for the generalization of the study results.
- Qualitative researchers, use the inductive approach to research and explore the observed data for the patterns and relationships and then develops and tests hypotheses to generate theory or uses developed theories to explain the data.

Concepts, constructs and variables

25

- In qualitative studies, the building blocks of a theory are called concepts.
- Researchers are unable to directly observe concepts in the real world but can measure them indirectly as a construct.
- A variable is a concept, which is observable and measurable and takes different values.

Dependent and independent variables

26

- Quantitative researchers are interested in knowing how the independent variable causes the change in the dependent variable, especially if the independent variable predicts the dependent variable .
- Does an educational intervention produce improvement in the reliability of OSCEs?
- Presumed cause is the independent variable (sometimes called the exposure or predictor) whereas the presumed effect is the dependent variable (sometimes called the response or outcome).

Examples

27

- How clerkship students interact with the parents of unconscious children in hospital?
- What are the processes and strategies of clinical reasoning used by the students to produce treatment?
- What are medical students understanding of empathy?

Key point

28

- Although quantitative and qualitative inquiry methods each have different underlying epistemological and ontological assumptions about the generation of knowledge and reality, their differences do not make one better or worse than the other.
- They are complementary rather than contradictory.

Steps of the research process

29

- The **quantitative** research processes have a linear sequence, and begins with the identification of research questions and ending with a statement answering those questions.
- The **qualitative** research process, on the other hand, tends to have a nonlinear sequence (or an iterative, repeating or recursive process).

Main steps in a quantitative study

30

- Defining the problem: knowledge gap
- Literature review: rationale for the study
- Develop a theoretical framework: formulates the research questions or hypotheses
- Constructing hypotheses: predicts the relationship between the independent variable and the dependent variable
- Quantitative research designs: experimental designs, quasi-experimental designs and surveys

Quantitative studies

31

■ General purpose

- Collect and analyze data to explain, predict, or control phenomena of interest
 - *Describe current conditions*
 - *Investigate relationships*
 - *Study causes and effects*

■ Assumptions of the researcher

- We live in a stable, uniform, and coherent world
- We can measure, understand, and generalize about our world
- Generally regarded as a *positivistic* perspective

32 Quantitative studies

- Five basic designs
 - Descriptive
 - Correlational
 - Causal-comparative
 - Experimental
 - Single subject

33 Quantitative Designs

- Descriptive

- Purpose – to describe the current status of a variable of interest to the researcher

- Examples

- *How many students drop out of the university?*

- *What are the attitudes of students and teachers concerning an extended school year?*

- *What kinds of activities typically occur in medical internship, and how frequently does each occur?*

34 Quantitative Designs

- Correlational

- Purpose – to ascertain the extent to which two or more variables are statistically related

- Examples

- *Is a teacher's sense of efficacy related to his/her effectiveness?*

- *Do significant relationships exist between the types of activities used in the classrooms and student achievement?*

- This design does *NOT* imply causation

35 Quantitative Designs

- Causal-comparative

- Purpose – to explore relationships among variables that cannot be actively manipulated or controlled by the researcher

- Examples

- *What is the effect of part-time employment on the achievement of students?*
 - *What characteristics differentiate students who drop out from those who do not?*

- An important characteristic is that the independent variable has already been manipulated

36 Quantitative Designs

- Experimental

- Purpose – to establish cause and effect relationships between variables

- Examples

- *What is the effect of teaching with (1) a co-operative groups strategy or (2) a traditional lecture approach on students' achievement?*

- *What is the effect of teaching with manipulatives vs. a traditional approach on students' test scores?*

- The important characteristics are that the researcher manipulates the independent variable and controls extraneous variables

Quantitative Designs

37

- Single subject
 - Purpose – to investigate cause and effect relationships with samples of one (1)
 - Examples
 - *What is the effect of a behavioral training program on students' ability to complete their performance tasks?*
 - The important characteristic is the use of specific interventions to cause behavioral changes in low incidence populations (e.g., special education)

Qualitative research designs

38

- Have different methods to capture the perspectives of participants
- Follow the process of 'bracketing', meaning that researchers need to put aside their own ideas and personal views about the phenomenon being studied
- This process of 'bracketing' that is used by researchers is called reflexivity.

39 Qualitative studies

■ General purpose

- To probe deeply into the research setting to obtain in-depth understandings about the way things are, why they are like that, and how participants perceive them

■ Assumptions of the researcher

- All meaning is situated in a particular perspective or context
- Different people and groups often have different perspectives and contexts, so there are many different meanings in the world
- Generally regarded as a post-positivistic perspective

Qualitative research methods

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- Phenomenology
 - Ethnography
 - Grounded theory

Phenomenology

41

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- Is the study of events and occurrences from the lens of each human being
 - The aim of phenomenology is to describe deeply the meanings of lived experience from the lens of participants who have directly experienced the phenomenon.
 - Our meanings and understandings of the world are constructed through social observations or when we interact socially together
 - Example: Lived experience of empathy in medical students

Ethnography

42

- Is particularly important in the context of sociological and anthropological research studies in educational environments
- The key element of an ethnography study is to explore the way of life in a group of people (the culture).
- The role of an ethnographer is to 'document the culture, the perspectives and practices of the people in their settings'.
- The aim is to 'get inside' the way each group of people sees the world: insider view or outsider view
- Example: How medical students communicate with patients/ health belief?

Grounded theory

43

- Is a qualitative inquiry method and inductive research that looks systematically at qualitative data with the aim of generating theories through the participants' standpoints.
- Constructs a theory about the basic social process (the process that participants solve their problems or concerns) related to the phenomenon under study
- To understand and explain how research participants interact or take an action about their main concerns/ comparative procedure in data analysis
- Data collection through in-depth interviews or observations continues until the theory/model has emerged
- Example: what is the process of making a medical diagnosis?

Population

44

- The population refers to the entire set of study participants to which results of the study are to be generalized.
- Medical education researchers are usually interested in the accessible population when they do not have access to the entire population.

Sampling procedures

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- A sample should be representative of all elements (individuals) in the target population.
 - There are two types of sampling procedures: random (or probability) and non-random (nonprobability) sampling.
 - The majority of medical education research studies are based on nonprobability sampling.

Non-probability sampling

46

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- Important methods used in medical education:
 - convenience sampling
 - purposive sampling
 - quota sampling

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- If the selection of elements (individuals) from the accessible population is based on ease or opportuneness, this is a convenience sample.
 - Purposive sampling: The selection of individual of the population is criterion-base or purposive. This method is also useful when researchers want to construct certain tools (e.g. psychometric scales/questionnaires).
 - Quota sampling: Within this strategy, subpopulations are identified and then the number of elements (individual) is selected based on the distribution of subpopulations.

Probability (random) sampling

48

- The study participants should be selected at a random basis, i.e., each participant has an equal chance of being selected
- Obtain a representative sample of the target population

Sample size

49

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- Sample size determination is a primary step of the research process in quantitative or qualitative methods.
 - Sample size in quantitative studies: thirty participants per variable may be considered
 - Sample size in qualitative studies: are usually small and non-random, with an intention of obtaining a rich description of the phenomenon
 - A phenomenology study, may use a sample ranging from 1 to 10 participants, or a grounded theory study may use from 10 to 60 participants
 - The key factor in evaluating sample size in qualitative research studies is the principle of data saturation

Data collection method

50

- In both approaches, the data collection process should be matched to the stated study design and the purpose of the study.
- Most common methods used in medical education research are:
self-administered questionnaires, focus groups and interviews
- Self-administered questionnaires are widely used in quantitative research methods.
- On the other hand, focus groups and interviews are commonly used in qualitative research methods.

Summary

51

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- Complementary nature of quantitative and qualitative approaches
 - Different purposes of research
 - *Explanatory*
 - *Exploratory*
 - Consideration of the strengths and weaknesses of different approaches for specific purposes

52 Conclusion

- The ultimate goal when choosing a design is to produce a credible answer to the research question
- The research question drives the choice of a research design

