

# Types of Educational Research

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# Outline

- Background
- Planning your research project
- Types of educational research
- Summary



# Why Do Medical Education Research?

- Deepen our knowledge of learning, teaching and education
- Not just to solve local concrete problems



# Background

- Educational research not well funded
- JAMA study calculated 75% studies self-funded
- Less than 0.04% of federal spending on graduate medical education is used on education research
- Most common reason for manuscript rejection:
  - Description of curriculum or intervention without outcome or evaluation data

# Problems with MER

- Many studies performed after the fact
- Retrospectively look for relationship among variables
- Focus has been learner oriented
  - Need to shift to patient-oriented outcomes

# Problems

- Overreliance on pretest
- Single- group pretest–posttest studies
- Multifactorial interventions
- Failure to explicitly define the interventions



# Challenge

- Randomized controlled studies (RCT's) usual gold standard of medical research
  - Most studies are observational cross sectional survey design
- MER deals with knowledge, behavior, skills, attitudes
  - Cross-over into social science
  - Difficult to apply RCT methods
  - Creates a barrier to funding



# Planning Ahead

- Not enough to just show that learners learn
  - Will the intervention change a behavior or attitude?
  - Will the intervention change patient care?
- Project must be evidence based
- Show outcome from the intervention
- Outcomes help to get funding

# Planning Your Project

- Refine the study question
- Create a conceptual or theoretical framework
- Choose a study design
- Select outcomes



# Refine the Study Question

- Ask an important question
- Will this study yield a practice changing result?
- Establish clear goals
- Form the hypothesis first
- Is your expected outcome interesting?
- Is the project really worth doing?

# Do a Thorough Literature Review

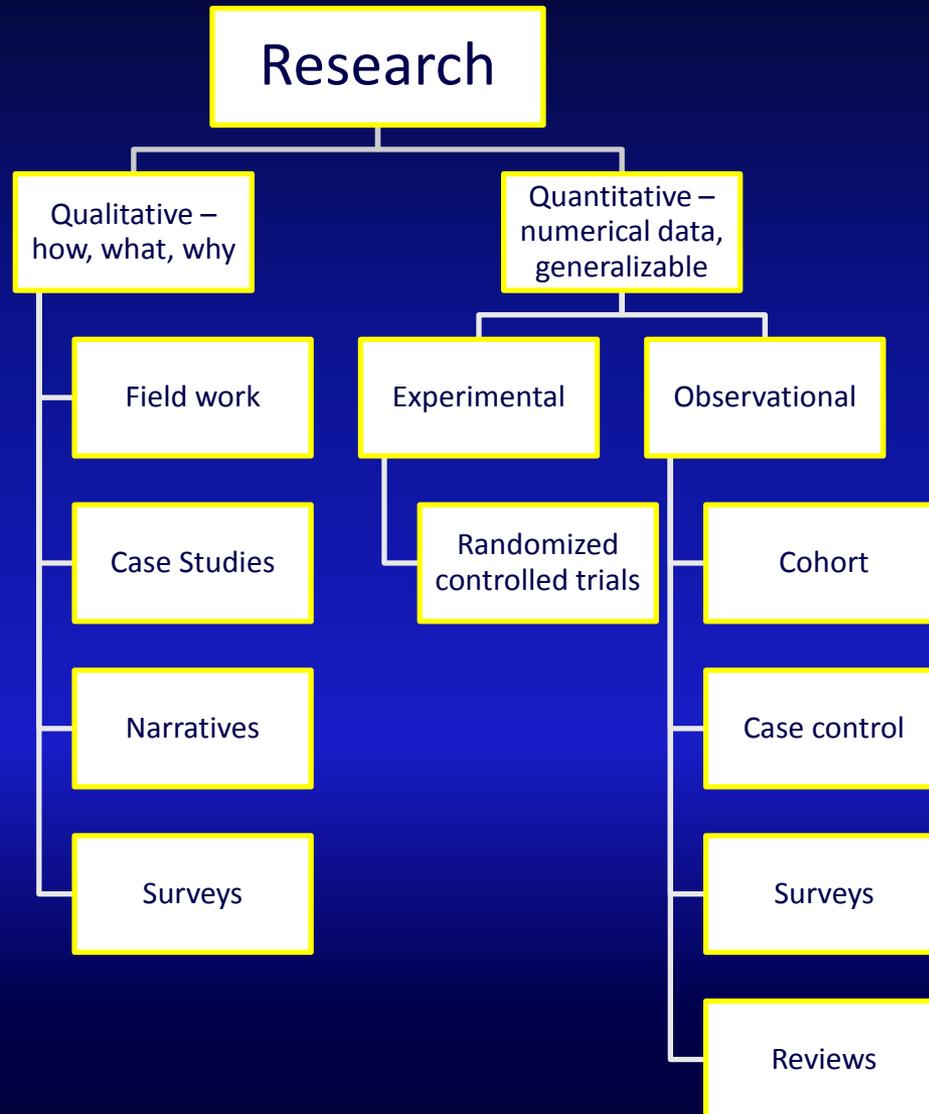
- Has this topic been written about before?
- Literature review defines the conceptual framework which determines the research method to be used
- Discuss this in the introduction of the manuscript or the grant proposal



# Conceptual Framework

- A theoretical roadmap for your project
- Unifies the paper
- Connects your purpose, literature review, methodology, data collection, and analysis
- Places the research question within the appropriate context
- Forms the basis for the hypothesis

# Select a Research Study Design



# Explorative studies

- Descriptive studies
  - Don't usually qualify as research
  - “Show and tell” description of a curriculum
- Qualitative studies
  - Use language based data, surveys
  - Interested in “what, how, and why” of phenomena
  - Focuses on social, individual
  - Can be complementary to quantitative
  - i.e. “What are current resident attitudes to the ABR restructuring of the boards?”

# Qualitative Research

- Grounded in social science, humanities, education, history
- Useful for theory building
- Deals with complex social questions and how they relate to health care
  - Social interactions
  - Emotional phenomena
  - How decisions are made
  - Assesses beliefs
  - Reflections on experience

# Types of Qualitative Research

- “Field work” –
  - studying and observing local sub-culture
  - i.e. operating room or clinics
  - Analysis of observations, interviews
- “Grounded Theory”
  - Explore social phenomena by developing explanations derived from the practical experience of study participants
  - i.e. Ginsburg’s study in developing a behavioral theory of professionalism

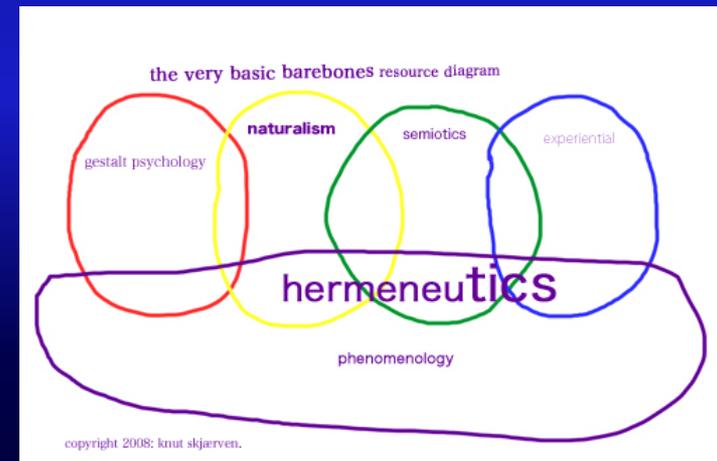
# Types of Qualitative Research

- Case Study:
  - Analysis of a particular system, phenomenon, group, or activity to gain understanding of a larger process
  - Use multiple data sources to understand the entity from multiple perspectives



# Types of Qualitative Research

- Phenomenology
  - Attempt to understand the nature of an experience or social phenomenon from the perspective of those who have lived it



# Qualitative Research

- Narrative research
  - Arises from practice of storytelling as a means of organizing and interpreting human experience
  - Analyzes personal accounts for meaning, context, as way of understanding an experience or situation



# Qualitative Research Approaches

- Interviews
- Focus groups/ group discussion
- Observation
- Review of documents



# Quantitative Research

- Experimental Studies
  - Seek to provide justification
  - Seek evidence of the effects of an intervention
  - Randomized controlled studies
- Observational studies
  - Cohort studies
  - Case-control studies
  - Associational studies

# Randomized Controlled Trial

- Usually considered the gold standard in biomedical research
- RCT examines whether an intervention works under circumstances that are controlled and standardized
- Random assignment of one subject or group to an intervention and another group to a non-intervention
- Minimizes the chances that there will be confounding variables between the two groups

# RCT

- Only controls for threats to internal validity from selection bias and changes to participants over time
- Does not control for threats by:
  - Location
  - Attitude
  - Implementation
- RCT's are not appropriate for all types of MER

# RCT - Challenges

- In an RCT, comparison between intervention/non-intervention flawed
- Intervention group will outperform a non-intervention group on a posttest
- Baseline measurement can influence the posttest result through test-enhanced learning
- If same posttest is used, learners will remember the test

# RCT- Challenges

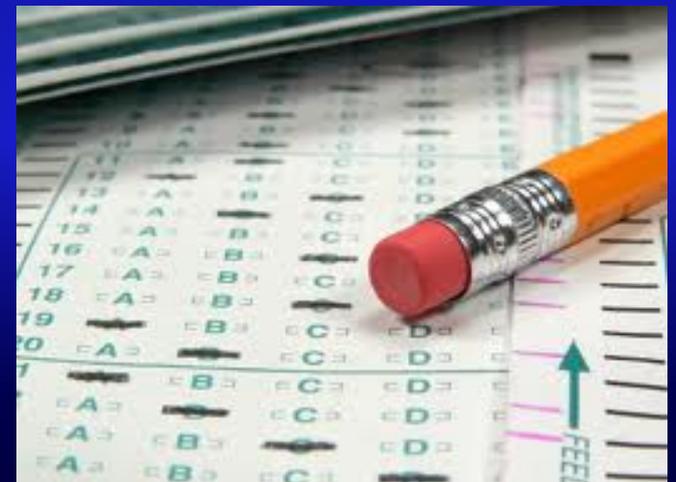
- Time – if posttest timed too close to intervention, does not test true learning or retention of knowledge or application of knowledge
- True randomization is difficult to accomplish in med ed
- Non-randomized = “quasi-experimental” studies

# RCT – Challenges

- May be difficult to administer different treatments for experimental and control group
- Learners may have opinions about benefits of the proposed intervention
- May be difficult to recruit enough subjects
- Homogenous populations may not translate to more general groups in educational practice

# Types of Pretest Posttest Designs

- Randomized Pretest Posttest
- Randomized Posttest Only
- Single Group Pretest Posttest



# Pretest Posttest Design

- Pretest-posttest, randomized design
  - Participants randomized to 2 or more conditions
  - Take a pretest
  - Undergo an intervention
  - Take a posttest
  - Typically held as a gold standard in MER

# Randomized Posttest Only

- Stronger design, preferred
- Pretest not necessary to ensure that randomized groups are equivalent at baseline

# Single Group Pretest Posttest

- Participants act as their own control group
- Frequent in MER
- If there is no control group, there are many threats to validity:
  - History, maturation, testing, instrumentation, regression, location, attitude
  - Difficult to draw inferences from research using this design

# Problems With Pretest Posttest Design

- Pretest affects performance on an identical posttest
  - Subjects familiar with the questions
  - May influence learning during the intervention, i.e. study for the test
  - A different posttest may have a different level of difficulty
  - Pretests don't adequately correct for baseline differences between study participants
  - Pretests and posttests introduce measurement error twice

# Pretest May Be Useful When:

- The sample size is small <40
- There is a high dropout rate
- Pretest is an integral part of the intervention
- There is a nonrandomized design

# Observational Studies

- Cohort
- Case Control
- Associational
- Use naturally existing groups of people rather than randomly selected samples
  - i.e. residency classes

# Cohort Study

- Observational study
- Outcomes of subjects with and without an exposure (or intervention) are compared
- Study begins with the predictor variable – i.e. the exposure or intervention
- What effect does the exposure have on the outcome?

# Cohort Study

- Subjects not randomized
- Subjects are members of a cohort as a result of processes beyond the experimenter's control, i.e. 2 residency classes
- Can be prospective or retrospective
- Frequently performed in medical education
- Example:
  - i.e. comparison of problem-based learning vs. lecture based curricula

# Case Control Study

- Observational study
- Subjects are selected on the basis of their outcomes
- “Cases” are the ones with the outcome being studied
  - i.e. start with learners who failed an examination or med students who chose radiology as a career and work backwards to assess the factors leading up to the outcome
- “Controls” are selected who did not have the outcome

# Case Control Study

- Useful where outcome is binary (yes/no)
- Prevalence of outcome is low
- Time delay until outcome occurs is long
- Usually retrospective
- Efficient way to link educational interventions to patient outcomes

# Observational Studies: Challenge

- Can't control for bias due to confounding variables
- Need to consult a statistician early in the planning stages of the study
- Observed associations can't be interpreted as causal but can direct future investigations using a RCT or other controlled study

# Correlational Studies

- Much medical education derived from survey questionnaires
- Search for relationship among variables
- Crossover between quantitative and qualitative methods

# Surveys/ Instruments

- Useful for analyzing knowledge, skills, behavior, attitudes, emotion, intention
- To develop an instrument, you need to define what is to be studied, how it is to be measured
- Define your subject population
- Requires a literature search
- Create a theoretical underpinning
- What other instruments exist?
  - Are they valid and reliable?

# Define the Content to be Measured

- There may not be much in the literature about the topic you want to study
- You may have to do a preliminary study first
- Qualitative study
- Needs assessment
- Focus group
- Interviews

# Pilot Testing

- Test drive the survey
- Send survey to a test group
- Get feedback
- See if they think the survey is organized
- Is the survey too long?
- Do they understand the questions?
- Are the responses in keeping with the questions?
- Make appropriate modifications

# Implement the Instrument

- Answers will be converted to numerical form and analyzed
- What kind of statistical analysis will you use?
- Nominal scale
  - Yes/no questions (yes=1, no=0)
- Interval scale
  - Answers are ranked
  - Distances between scale points are equal
  - Likert scale

# Some Survey Writing Tips

- How will you maximize your response rate?
  - Goal >60% for mail and internet
- Simplify
- Organize questions into themes
- Place demographics and controversial items at the end – you want the respondents to complete the survey!
- Ask one question at a time
  - Avoid double barreled questions

# Survey Tips

- Try to eliminate leading questions, assumptions and bias in question writing
- Avoid double negatives
- Make survey visually attractive
- Remember, respondents are not that motivated – you need to incentivize them
- Keep it short – less than 5 minutes is best

# Survey Introductory Paragraph

- Sponsors of the study
- Purpose of the study, types of questions to be asked
- How was the respondent chosen for this study?
- Is there an “opt out” option?
- How long will this take?
- Are the answers confidential? Will the respondent’s identity be kept confidential?
- How will this data be used? Will it be published?

# Reviews

- Scholarly reviews are valuable
- Synthesize available evidence
- Refine understanding of a problem and the implications of literature for application to practice



# Systematic Reviews

- Systematic search for all relevant literature pertaining to research topic
- Systematic selection of articles of quality
- Systematic summary with statistical methods to best estimate the effect in question



# Meta-Analyses

- Combine effect sizes from each article reviewed
- Weight each article by sample size
- Arrive at average effect size
- Difficult to do due to heterogeneity of study designs, interventions, outcome measures

# Critical Reviews

- Present a critical synthesis of the literature
- Identify what is well established
- Identify what is not well understood
- Identify what needs to be better understood
- Present a new perspective

# Take Home Points

- Careful attention to study design in the planning stages will ensure success
- Define the intervention, research method and the outcome clearly at the outset
- More success in publications and grants if outcome results in change in behavior or patient care

