What is Research?

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How to do Research: solve a problem, publish

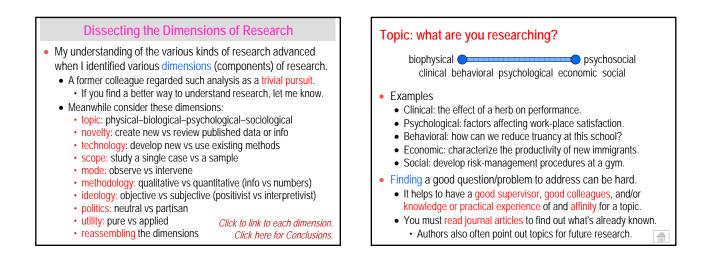
Dissecting the Dimensions of Research:

topic, novelty, technology, scope, mode, methods, ideology, politics, utility

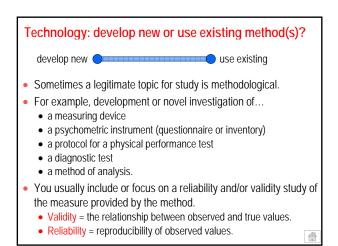
Reassembling the Dimensions: quantitative vs qualitative research

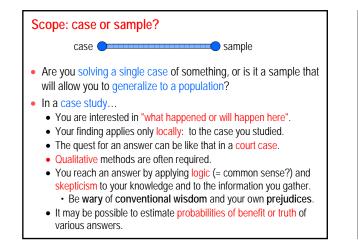
How to do Research

- Research is all about addressing an issue or asking and answering a question or solving a problem, so...
- Identify an issue, question, or problem.
 Talk with people who want or need your study.
- Find out what's already known about it.
- Talk with experts and/or read their reviews and the original research on the topic.
- Plan, cost, and do your study accordingly.
- Write it up and submit it for assessment.
 - Better still, do a good job on it and submit it for publication.
 - Undergrad projects are sometimes good enough to publish.
 - Your work will benefit more people if you publish it.
 - Rule No. 1 in academia is publish or perish.
- This slide show is about different types of research you can do.





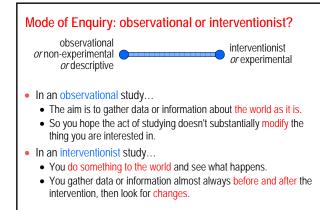




- In a study of a sample...
 - You are interested in "what happens in general".
 - Rarely, "what" is simply descriptive: the frequency, mean value or other simple statistic of something in the sample.
 - Most often, the "what" is the value of an effect statistic: the relationship between the thing of interest (a dependent variable, such as health, performance...) and something else (a predictor variable, such as training, gender, diet...) in the sample.
 - Examples of effect statistics: difference or change in a mean value; ratio of frequencies (relative risk); correlation coefficient.
 - You control for other possible predictor variables either by holding them constant or measuring and including them in the analysis.
 - Example: the effect of physical activity on health, controlling for the effect of age on health.
 - In controlled trials (interventions), a control group accounts for any effect of time that would have happened anyway.

• More about studying a sample...

- You study a sample, because it is impractical and wasteful (and therefore unethical) to study a population.
- "What happens in general" refers to the average person or situation in a population represented by your sample.
- "Population" is a defined group, not the entire human race or all possible situations.
- You make inferences about that population; that is, you generalize from the sample to a population.
 - You can make inferences to other populations only if you can argue that those populations are similar to your sample with respect to the effect you have studied.
- There are several ways to generalize from sample to population...
 Old: develop a null hypothesis about a relationship, then test the hypothesis (that is, try to falsify it) using statistical significance based on something called the P value.
 - New: identify a relationship, measure its magnitude, state the uncertainty in the true value using confidence limits, then make a conclusion about its clinical or practical importance in the population.
- Sample size is a big issue.
 - The smaller the sample, the more the uncertainty.
 - A stronger relationship needs less certainty.
 - So a stronger relationship needs a smaller sample.
 - Unfortunately most relationships are weak or trivial, so you usually need large samples.



- The following comments refer to observational and interventionist studies with samples.
- The estimate of the magnitude of a relationship is less likely to be biased (that is, not the same as in a population) if...
 - the sample is selected randomly from the population, and...
 - you have a high compliance (low proportion of dropouts).
- An observational study of a sample...
 - usually establishes only an association between variables rather than a causal relationship;
 - needs hundreds or even thousands of subjects for accurate estimation of trivial or small effects.

- Types of observational study with a sample, weak to strong:
 Case series, e.g. 20 gold medallists.
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 Cross-sectional (correlational), e.g. a sample of 1000 athletes.
 - Cross-sectional (conclational), e.g. a sample of 1000 anneles.
 Case-control (retrospective), e.g. 200 Olympians and 800 non-Olympians.
 - Cohort (prospective or longitudinal), e.g. measure characteristics of 1000 athletes then determine incidence of Olympic medals after 10 years.
- In an intervention with a sample...
 - You can establish causality: X really does affect Y.
 - You may need only scores of subjects for accurate generalization about trivial or small effects.
 - The outcome is the effect of a treatment on the average subject.
 - Researchers usually neglect the important question of individual responses to the treatment.

- Types of intervention with a sample, weak to strong:
 - No control group (time series), e.g. measure performance in 10 athletes before and after a training intervention.
 - Crossover, e.g. give 5 athletes a drug and another 5 athletes a placebo, measure performance; wait a while to wash out the treatments, then cross over the treatments and measure again.
 - Ethically good, because all subjects get all treatments.
 But can't use if the effect of the treatment takes too long to
 - wash out.
 - Each subject can receive more than two treatments.
 - Controlled trial, e.g. measure performance of 20 athletes before and after a drug and another 20 before and after a placebo.
 - You need up to 4x as many subjects as in a crossover.

- In interventions, bias is less likely if...
 - Subjects are randomly assigned to treatments.
 - Assignment is balanced in respect of any characteristics that might affect the outcome.
 - In other words, you want treatment groups to be similar.
 Subjects and researchers are blind to the identity of the active
 - and control (placebo) treatments.
 - Single blind = subjects don't know which is which.
 - Double blind = the researchers administering the treatments and doing the measurements and analysis don't know either

Methods: quantitative or qualitative?

quantitative

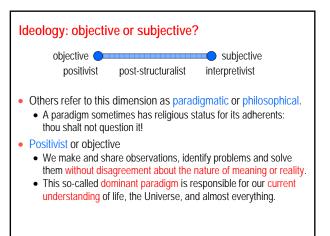
- With quantitative methods...
 - You gather data with an instrument, such as a stopwatch, a blood test, a video analysis package, or a structured questionnaire.

qualitative

- You derive measures or variables from the data, then investigate relationships among the variables.
- Some people think you have to do it by testing hypotheses.
 Error of measurement is an important issue.
- Error of measurement is an important issue.
 - Almost all measures have noise or other errors.
 Errors affect the relationship between measures.
 - Errors affect the relationship between measure
 You attend to errors via validity and reliability.
 - A **pilot study** to investigate error can be valuable.

With qualitative methods...

- You gather information or themes from texts, conversations or loosely structured interviews, then tell a coherent story.
 Software such as NVivo can help.
- The open-ended nature of these methods allows for more flexibility and serendipity in identifying factors and practical strategies than the formal structured quantitative approach.
- The direction of the research may change mid-stream.
- Formal procedures enhance trustworthiness of the information.
 - Triangulation-aim for congruence of info from various sources.
 Member checking or respondent validation-the subjects
 - check the researcher's analysis.
 - · Peer debriefing-colleagues or experts check the analysis.
- Hybrid or mixed method: analyze a sample of cases
 qualitatively, then code information into values of variables to
 make inferences about a population quantitatively.

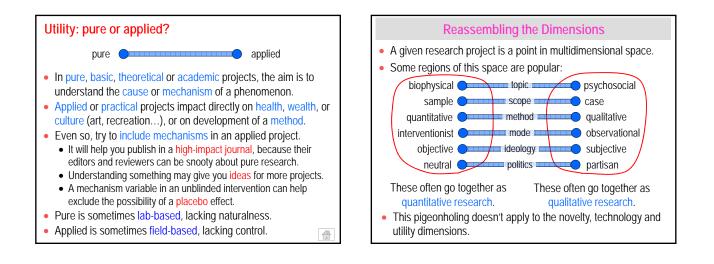


Post-structuralist

- The researcher views people as subjects of discourses (interrelated systems of unstable social meanings).
- Although the subjectivity of research is emphasized, the researchers attempt to achieve objectivity. Do they succeed?
- Many people find post-structuralist papers hard to understand.
 Alan Sokal, a physicist, wrote a nonsensical paper-Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity-and got it accepted by the journal Social Text.
- Interpretivist
 - Part of the truth of a situation can be found in the researcher's interpretation of the self-understandings of participants.
 - Truth is discovered partly by thought as well as by observation.
 - Grounded theory of social science is interpretivist: truth emerges
 - from your observations; you do not test a hypothesis.



Maybe that's OK, because their stance stimulates debate.



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- Some regions are less popular, but worth visiting. For example:
 - Action research is a subjective intervention with a case or sample.
 Dealing with the problems of everyday life is an informal kind of action research.
 - Some researchers identify the extreme subjects in a quantitative survey, then interview them subjectively/qualitatively as cases.
 - Others do a qualitative pilot study of a few cases to identify a problem and the appropriate measures for a larger quantitative study of a sample.
- A project based in an unusual region may give new insights...
 - But you may struggle to publish in journals devoted to more popular regions.
- Researchers who mix qualitative methods (such as intensive interviews) with studying a sample (for generalizing to a population) can run into a sample-size problem, as follows...

- Qualitative methods applied to a sample often result in a small sample size because...
 - subjects are hard to get, or...
 - the interviews are too time consuming, or...
 - the researchers dislike the idea of large samples.
- But a study with a small sample can adequately characterize only strong associations (large effects) in a population.
- So these small-scale qualitative studies are not definitive for a small or trivial effect.
- Furthermore, open-ended inquiry is equivalent to assaying many variables, so there is a high risk of finding a spurious association.
- If the sample is small, the spurious association will be strong.
- Therefore small-scale qualitative studies are not definitive even for a moderate or large effect.
- Bottom line: when using qualitative methods to generalize to a population, you need a large sample to characterize small effects.

In Conclusion...

- A given research project can be characterized by topic, novelty, technology, scope, mode, methods, ideology, politics and utility.
- This dimensional view may help you sort out a good approach to a specific project, but...I may have missed or mangled some dimensions.

 - There may be better ways to understand research.
- Your work needs to be credible to some people and preferably also published if it's to have any impact.

This presentation is updated from a paper at:

SPORTSCIENCE

A Peer-Reviewed Site for Sport Research

sportsci.org

Hopkins WG (2002). Dimensions of research. Sportscience 6, sportsci.org/2002