Your Educational Scholarly Project: From Idea to Analysis to Dissemination

APPD and COMSEP
Research and Scholarship Task Forces
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Today we will help you...

• Review domains of educational scholarship
• Develop a SMART research question
• Understand types of studies and choose a study design to answer your question
• Understand basic statistical tests and choose tests to answer your question
• Review ways to disseminate your project
Educational Scholarship

• The Scholarship of Discovery

• The Scholarship of Integration

• The Scholarship of Engagement
  (previously called Application)

• The Scholarship of Teaching
6 Standards of Quality Scholarship

Glassick, Huber, Maeroff

• Clear Goals
• Adequate Preparation
• Appropriate Methods
• Significant Results
• Effective Presentation
• Reflective Critique
Hierarchy of Evidence

• General concepts:
  • Strength of evidence varies based on type of research methodology
    • Quantitative: Experimental design > observational study
    • Qualitative: Generalizable study ??> single case study
  • Contextual factors should be considered
    • Appropriateness of target population
    • Applicability to one’s own population
    • Feasibility
First Step: The Institutional Review Board
Asking a SMART Research Question
Start with the Research Argument

1. The problem in the universe
   - What is wrong, undesirable, or unknown about the way things work?

2. The unknown
   - What is known in the literature?
   - What is unknown?

3. How will your research fill those gaps?
• The first part of convincing your audience that your study is important is convincing them that the underlying problem is important.

• If a study is not worth doing, it is not worth doing well
The Research Question

• You have a compelling research argument, but is this the right research question?
The SMART Research Question

**Specific:** simple to understand

**Measurable:** able to assess pertinent variables and outcomes

**Achievable:** Within a reasonable timeframe to stakeholders

**Relevant and not Rehashing:** Adds to existing knowledge

**Timely:** obtain relevant answers within a specified period
Types of Research Questions

• Exploratory ("The What" Questions)
  • Seeks to gain an understanding of a new topic

• Descriptive ("The How and Who" Questions)
  • Presents a picture of a specific situation

• Explanatory (The "Why" Questions)
  • Identifies the reasons why certain things occurs
• “To accomplish the goal of advancing CBME through use of the Pediatrics Milestones as road maps for learning and assessment, learner and faculty buy-in and understanding are critical.

• Thus, the purpose of this study was to determine how pediatric residents understand, process, and respond to a representative sample of the PMDs.”

• Methods: Cognitive interviews with 48 pediatric residents at 2 residency programs.

Assessing our Example

• Step 1: Was the research argument compelling?

• A proposed alternative:
  • Nearly 10 years after the ACGME initiated the Outcomes Project, it remains unclear how to measure achievement in the competencies
  • Pediatric Milestones represent the next level of outcomes assessment in Graduate Medical Education, through which program directors can better judge whether a resident is a “good doctor”
  • No studies have evaluated the resident perspective on Pediatric Milestones, although learner buy-in will be critical to their successful use
Does it Fulfill SMART Criteria?

- **Specific, Simple:**
  - “To determine how pediatric residents understand, process, and respond to a representative sample of the PMDs”

- **Measurable:**
  - Qualitative data gathered from interviews; Exploratory

- **Achievable:**
  - Study population: residents at lead author’s program
  - Interviews and primary data coding done by lead author
  - 3 outside researchers coded a subset of transcripts
Does it Fulfill SMART Criteria?

- Relevant and not rehashing
  - Laid out by research argument
- Timely
  - PGY2s and PGY3s recruited in July 2010
  - PGY1s recruited in November 2010
  - Interviews completed by February 2011
  - Publication January 2013
Research is an Iterative Process

• It can take weeks to refine a research question.
• It can take a career to ask and answer the question you’ve always wanted to ask.
Using Literature Review to Refine Your Question
Understand the Existing Scholarship

• What has already been done?

• Where are the gaps in knowledge?
Searching the Literature

• **PubMed** isn’t always enough for educational research
  - Best Evidence Medical Education Collaboration
    - [www.bemecollaboration.org/](http://www.bemecollaboration.org/)
  - **ERIC** -- National Education Database
  - **PsycINFO** – citations related to psychology and other disciplines including education and medicine
  - **Google Scholar**
Searching for additional resources

• MedEd PORTAL
  • Peer reviewed publications of medical education teaching and assessment resources

• APPD Share Warehouse

• MERLOT
  • Similar to MedEd PORTAL but for all of higher education
General Framework for Choosing Study Design
Research Design Basics

Your question drives your research design

• Exploratory?

• Descriptive?

• Explanatory?
Research Design Basics

Do you want to:

• explore something new?
• describe something in more depth?

• show a relationship?
• predict an outcome?
• compare a new and old strategy?

Study Type

1. Descriptive

2. Hypothesis-Driven
<table>
<thead>
<tr>
<th>Study Question</th>
<th>Study Type</th>
<th>Study Design</th>
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<tbody>
<tr>
<td>Describe/Explore a group or phenomenon?</td>
<td>Descriptive, Qualitative</td>
<td>• Ethnography&lt;br&gt;• Case Studies&lt;br&gt;• Grounded Theory</td>
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<td>Descriptive, Quantitative</td>
<td>• Cross-sectional (i.e. survey)</td>
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<td>Hypothesis-Driven, Quantitative</td>
<td>• Experimental (randomized control)&lt;br&gt;• Quasi-experimental (nonrandom control)&lt;br&gt;• Single Subject (pre/post test)&lt;br&gt;• Cohort / Causal Comparative</td>
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Descriptive Research Questions

You have a question . .  and are open to the answer

• What is the current state of cultural competency teaching and learning in pediatric clerkships? (Mihalic et al, Acad Med 2007)

• How do pediatric residents understand, process, and respond to the Pediatric Milestones? (Schumacher et al, Acad Ped 2013)

• What are the critical steps in developing, implementing, and evaluating a residency continuous quality improvement (CQI) curriculum? (Djuricich et al, Acad Med 2004)

• What are students’ perceptions of evaluations in undergraduate medical education? (Schiekirka et al, BMC Med Ed 2012)
Descriptive Studies: Qualitative vs Quantitative

What type of data will best answer your question?

• Answer with numbers?
  • Categorize and count outcomes
  • Calculate average outcomes
  • Describe numerical variations in outcomes

• Answer with words?
  • Understand a culture
  • Explain a phenomenon
  • Form a theory
When are Qualitative Methods helpful?

• When you want a few in-depth answers
• When you want to examine reasons
• For breadth, depth, descriptive information
• When you want to understand research participants’ perspectives in an open-ended way
• To discover what variables might be important, generate grounded hypotheses or theory
• To develop a “profound grasp of the obvious.”

(Hurley RE. Qualitative research and the profound grasp of the obvious. *Health Services Research*, 1999;34:1119-1136)
Qualitative Data Can Include:

- Interviews
- Observations
- Videos
- Documents
- Drawings
- Diaries
- Historical documents
- Questionnaires (sometimes considered secondary sources)
- Focus groups
- Narrative writing
Hypothesis Driven Studies:

You have a question . . . and an expected answer

• Which of two teaching methods is more effective at increasing students’ recognition and assessment of common ethical dilemmas?
  
  (Smith et al, Acad Med 2004) **Comparison**

• What is the relationship between medical student burnout, empathy and professional climate?
  
  (Brazeau et al, Acad Med 2010) **Correlation**

• How well does the in-training exam predict performance on the general pediatrics certification exam?
  
  (Althouse et al, J Peds 2008) **Predication**
## From Study Question to Study Design

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<td>• Cohort / Causal Comparative</td>
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Hierarchy of Evidence

- Randomized Control (Experimental)
  - Nonrandomized Control (Quasi-Experimental)
    - Single Subject, pre/post-test
    - Cohort (post test only)
    - Cross-sectional
Randomized Control Study Design

- Study Population
- Randomization
  - Intervention group
  - Control group
- Outcome
- Outcome
- Time
Quasi-Experimental Study Design

Study group A
Baseline data (pre test)
Intervention
Outcome (post test)

Study group B
Baseline data (pre test)
"Standard" treatment
Outcome (post test)

Target Population
Single Subject / Case Study

- Study Population
- Baseline data (Pre test)
- Intervention
- Outcome (Post test)

Time
Cross-Sectional Study Design

- Study Group
- All variables or outcomes

Time
Cohort Study / Causal Comparative

Target Population

Exposed / Trait + → Outcome

Not exposed / Trait - → Outcome

Time

Time
# Study Design: Advantages & Disadvantages

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<th>Study Design</th>
<th>Advantages</th>
<th>Disadvantages/Threats</th>
</tr>
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<td>Randomized Control</td>
<td>• Reduces allocation bias (minimizes baseline differences)</td>
<td>• Difficult!</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Does not address non-uniform intervention</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Intervention “diluted”</td>
</tr>
</tbody>
</table>
| Quasi-Experimental (nonrandom control) | • More practical  
• Still able to compare to control          | • May need to control for baseline differences                                        |
|                                 |                                                                           | • Impact of different sites/times                                                      |
| Single Subject (pre/post)       | • No need for control  
• Can show change                  | • Cannot show causality                                                                |
| Cross-sectional (post only)     | • Avoids learning from pretest                                           | • Cannot show causality                                                                |
Research Design: Next steps

**Descriptive studies:**
- What is your population?
- What is the scope?
- How will you sample?
- What will you observe, measure or record?
- What is your data analysis plan?
- How will you convey your description?

**Hypothesis-driven studies:**
- What is your population?
- What is your intervention?
- What is your control?
- What variables will you manipulate?
- What outcome variables will you measure?
- How will you control for cofounders?
- Will you have sufficient power to show a difference?
Study Design Examples
Instructions for ARS

- Audience Response System
- Text choice of answer to
- Only “vote” once
Describe beliefs about Family Centered Rounds (FCR)

- Survey of US Pediatric clerkship directors via COMSEP annual survey
- Objective: Assess proportion of students participating in FCR, describe curricula for teaching FCR, and describe beliefs about FCR
- Used validated survey instrument
- Comparison of responses for clerkship directors that taught FCR v. those that did not
  - FCR enhances education of medical students
  - FCR are important to teach
What Study Type is This?

1. Qualitative
2. Cross-Sectional
3. Cohort
4. Single Subject (*single group)
5. Quasi-Experimental
6. Experimental (randomized controlled)
How to Define & Assess Professionalism

• No current standard evaluation tool used in pediatric clerkships to identify unprofessional behavior

• Conducted focus groups with medical students, residents & faculty from 2 medical schools in CT to:
  • define important behaviors related to professionalism
  • identify barriers to successful assessment
  • discuss ways of formulating an evaluation tool

• Identified themes
What Study Type is This?

1. Qualitative
2. Cross-Sectional
3. Cohort
4. Single Subject (*single group)
5. Quasi-Experimental
6. Experimental (randomized controlled)
The Impact of an Objective Structured Teaching Evaluation on Faculty Teaching Skills

- Does an OSTE improve faculty teaching evaluation scores and faculty satisfaction?
- 46 faculty members participated in the OSTE from 2004-2007
- Faculty self assessed teaching abilities with a retrospective pre-post-test survey and completed satisfaction questionnaires regarding their OSTE experience
- Compared faculty teaching evaluations for the 6 months before and after the OSTE
- After the OSTE, faculty reported statistically significant improvements in all self-assessed teaching skills
- No improvement in their teaching evaluations

What Study Type is This?

1. Qualitative
2. Cross-Sectional
3. Cohort
4. Single Subject (*single group)
5. Quasi-Experimental
6. Experimental (randomized controlled)
Simulation-Based Training of Internal Medicine Residents in Advanced Cardiac Life Support Protocols

• Does practicing ACLS protocols in the sim lab improve resident performance on code scenarios in the sim lab?
• Baseline evaluation in all residents
• Intervention group received 4 education sessions using a medical simulator. All residents were then retested. After crossover, the wait-list group received the intervention, and residents were tested again.
• Performance was assessed by comparison to AHA guidelines for treatment of ACLS conditions with interrater and internal consistency reliability estimates.

J Gen Intern Med. 2006 March; 21(3): 251–256.
What Study Type is This?

1. Qualitative
2. Cross-Sectional
3. Cohort
4. Single Subject (*single group)
5. Quasi-Experimental
6. Experimental (randomized controlled)
Relationship Between OSCE Scores and Other Typical Medical School Performance Indicators

• Is there a correlation between 2nd and 3rd year OSCE scores?

• Is there an association between OSCE scores and other measures of students' medical school performance?

• Tracked the performance of classes of 2007-2011
  • Calculated the univariate correlations among OSCE scores, U.S. USMLE scores, and medical school GPA
  • Examined whether OSCE scores explained additional variance in the USMLE Step 2 CK score beyond that explained by the Step 1 score

Military Medicine, 177, 9:44, 2012
What Study Type is This?

1. Qualitative
2. Cross-Sectional
3. Cohort
4. Single Subject (*single group)
5. Quasi-Experimental
6. Experimental (randomized controlled)
Choosing Study Variables
What data do you need to collect?

• Baseline data
  • Demographics (age, gender, geographic location)
  • Prior training/experience (MCAT, # of rotations)

• Outcome data
  • Knowledge (MCQ exams)
  • Attitudes (satisfaction ratings, confidence scales, Jefferson Scale of Empathy)
  • Skills/Behaviors (self-report changes in skills, validated checklist of observed skills/behaviors)
# Variable Types (Quantitative)

<table>
<thead>
<tr>
<th>Examples</th>
<th>Variable Description</th>
<th>Variable Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>• MCQ exam</td>
<td>Numerical scale without gaps</td>
<td>Continuous</td>
</tr>
<tr>
<td>• Student age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pass/Fail exam</td>
<td>Two possible outcomes</td>
<td>Dichotomous</td>
</tr>
<tr>
<td>• Satisfaction likert scale (strongly agree, etc)</td>
<td>Rank order of items</td>
<td>Ordinal</td>
</tr>
<tr>
<td>• College major</td>
<td>Discrete value</td>
<td>Nominal</td>
</tr>
</tbody>
</table>
Know Thy Variables!

Individual items: **Ordinal**

**Example Likert Scale**

1. Wikipedia has a user friendly interface.
   - strongly agree
   - agree
   - neutral
   - disagree
   - strongly disagree

2. Wikipedia is usually my first resource for research.
   - strongly agree
   - agree
   - neutral
   - disagree
   - strongly disagree

3. Wikipedia pages generally have good images.
   - strongly agree
   - agree
   - neutral
   - disagree
   - strongly disagree

4. Wikipedia allows users to upload pictures easily.
   - strongly agree
   - agree
   - neutral
   - disagree
   - strongly disagree

5. Wikipedia has a pleasing color scheme.
   - strongly agree
   - agree
   - neutral
   - disagree
   - strongly disagree

Summed items: **Continuous**

**Figure 8.1 The Rosenberg Self-Esteem Scale**

Circle one response for each of the following ten items.

<table>
<thead>
<tr>
<th>Item</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
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<tr>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>7.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>8.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

Items marked with an asterisk have reversed wording. The numbers on items with reversed wording could be reversed before summing the responses for the ten items. For example, on item 3, “strongly agree” becomes 4, “agree” becomes 3, “disagree” becomes 2, and “strongly disagree” becomes 1.

Outcomes for Curricular Evaluation

Figure 2  Kirkpatrick’s levels.

Commonly Used Statistical Tests
Variables

• Characteristics
  • Descriptive

• Relationships
  • Causal
  • Association

• Variable Types
  • Dependent
  • Independent
  • Categorical vs. Measured
Variables

• Dependent/Criterion
  • Variable being measured, data or score

• Independent
  • Variables controlled by the experimenter

• Discrete
  • Variables with limited possible values

• Continuous
  • Variables that can assume the full range of values
Data Distribution

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Analysis Types

- Descriptive
- Comparative
- Correlation
- Regression
Cross Sectional or Single Subject Study Design

- Group identified and described
- Analyses
  - Descriptive
  - Comparative: Possibly t-tests or correlation
Descriptive Analysis

1 Group

Continuous

- Means, Std Dev
- Median (Interquartile Range)

Dichotomous

- Proportions

Ordinal

- Median (Interquartile Range)

Nominal

- Frequencies

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Experimental Study

- Randomization
  - Control/Experimental Groups
- Quasi-experimental Differences
- Analyses
  - T-tests (independent means or correlated means)
  - Analysis of Variance/Covariance
  - Non-parametric Analyses
  - Chi-square
Comparative Study

• Similarities to Experimental Methods
  • Independent group comparisons

• Differences with Experimental Methods
  • No manipulation of independent variable

• Analyses
  • T-tests (independent means or correlated means)
  • Analysis of Variance/Covariance
  • Non-parametric Analyses
  • Chi-square
Comparative Analysis

2 Dependent Groups

- Continuous
  - normal: t-tests
  - not normal: Wilcoxon rank sum

- Dichotomous
  - Chi-square, Fisher’s exact

- Ordinal
  - Wilcoxon rank sum, Mann-Whitney U

- Nominal
  - McNemar’s Test

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Comparative Analysis

2 Independent Groups

- Continuous
  - normal: t-tests
  - not normal: Wilcoxon rank sum

- Dichotomous
  - Chi-square, Fisher’s exact

- Ordinal
  - Wilcoxon rank sum, Mann-Whitney U

- Nominal
  - Fisher’s exact

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Comparative Analysis

>2 Independent Groups

- Continuous
  - normal: ANOVA, ANCOVA, MANOVA
  - not normal: Kruskal-Wallis

- Dichotomous
  - Chi-square

- Ordinal
  - Kruskal-Wallis

- Nominal
  - Chi-square

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Correlation & Regression Studies

• Uses
  • Clarify relationships
  • May offer predictive ability

• Does **NOT** indicate causation

• Analyses
  • Correlational
  • Regression
  • Non-parametric Analyses
Correlation Analysis

>2 Variables

Continuous

- Normal
  - Pearson’s R

- Not normal
  - Spearman’s R

Ordinal

- Cronbach α, Kappa statistic, Kuder-Richardson

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Survey Analysis

• Uses
  • Describe characteristics of a population

• Convenience or Purposeful Sampling

• Analyses
  • Descriptive
  • Comparisons (t-tests or ANOVA)
  • Chi-square
  • Non-parametric Analyses

• Validity & Reliability
  • Application of correlation to validate instrument
Example

- Type of Study: Hypothesis-driven
- Study Design: Cross-sectional
- Variables: Demographic Data, Questionnaire, Self-directed learning efficacy
- Statistics: Regression
Regression Analysis

>2 Variables

- **Continuous**
  - Regression (simple, multiple)
- **Dichotomous**
  - Logistic Regression
- **Ordinal**
  - Ordinal Logistic Regression
- **Nominal**
  - Multinomial Logistic Regression

Adapted from Windish et al., J Gen Intern Med 2006; 21:656-660.
Reminders

• **DO**
  • Read articles in the journal you plan to submit to
  • Report statistics appropriately; i.e., r-value with correlation, effect size with regression, confidence intervals, etc.
  • Summarize results using tables/figures

• **DON’T**
  • Collect data without a clear plan of analysis
  • Make weak results sound grandiose
  • Bury results in text
Ideas for Dissemination
Disseminate your Scholarship

- Journal publication
  - Print
  - Online
- Presentation
- MedEdPORTAL
Peer-reviewed Journal

- Academic Medicine
- Academic Pediatrics
- Best Evidence in Medical Education
- BioMed Central Medical Education
- JAMA (annual medical education issue in September)
- Journal of Graduate Medical Education
- Medical Education
- Medical Education Development
- Medical Education Online
- Medical Teacher
- Teaching and Learning in Medicine
- The Clinical Teacher
Presentation

• National/International
  – APPD
  – COMSEP
  – AAMC
  – PAS
  – AMEE (International Association for Medical Education)

• Regional
  – APA Regional meetings
  – APPD Regional meetings
Peer-reviewed Educational Resource

- MedEdPORTAL
- [https://www.mededportal.org/](https://www.mededportal.org/)

- In some institutions, publications in MeEdPORTAL similarly weighted as publications in traditional print journals