

An Introduction to Doing Research in Medical Physics Education

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Objectives

- Specify some challenges to conducting research in professions education
- Use a typology of scholarship to pursue different kinds of educational research
- Identify and address common research strategies and opportunities



What if we did biomedical research under the conditions of educational research...











Gruppen, 2008





















This is not a place for wimps!

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"Imagine how difficult physics would be if electrons could think?"

Murray Gell-Mann (1929-2019) 1969 Nobel prize in physics



How Then Do We Think About Scholarship in Radiation Physics Education?



Boyer's Typology of Scholarship

- Discovery original research to advance knowledge
- Integration synthesis of information across disciplines, topics, time
- Application/engagement use of research findings to solve problems
- Teaching systematic study of teaching and learning processes (not just doing it)

Boyer, E. Scholarship reconsidered. 1990



Scholarship of Discovery

original research to advance knowledge



Foundational Questions

- What is professionalism?
- How do interprofessional teams work?
- How are basic and clinical sciences integrated in clinical problem solving?
- How do clinicians make decisions about continuous, self-directed learning?
- What are the unique characteristics of international care and education?



Pragmatic Questions

- Is this method of teaching better?
- How much assessment do we need to do in communications?
- Should we try team-based learning?
- How can we make geriatrics more attractive?



Where Do Questions Come From?

- Faculty observations of their own teaching
- Problems encountered with students
- Institutional goals or initiatives
- Environmental constraints or changes
- Colleagues and the literature
- Creative curiosity



Good Scholarship Starts with a Good Question

- Know the literature before going too far
- Embed question in a theory or model
 - Connects results to larger framework
 - Link to prior results
- Make your question detailed and precise
 - Almost always too large at first



Scholarship of Integration

synthesis of existing research findings and results across disciplines, topics, time



Examples

- Systematic reviews of research
 - "The effectiveness of self-assessment on identification of learner needs"
- Synthetic reviews of innovations
 - "The effectiveness of case-based learning"
- Theoretical integrations across multiple disciplines
 - "Chaos and complexity theory in medical education"



Integration

- Requires breadth of knowledge of the domain, literature, issues
 - Theoretical
 - Practical
- Identify themes and problems
- Link concepts and findings
- Be thoughtful, creative, and insightful



Best Evidence Medical Education (BEME)

- Analog to the Cochrane and Campbell collaborations
- International in scope
- Develop and disseminate evidenceinformed educational decisions
- Systematic reviews

http://www.bemecollaboration.org



Scholarship of Application

use of research findings to solve problems "evidence-based education"



Examples

- Educational technology studies to design computer-aided instruction
- Efficacy of Team- or Problem-based
 Learning in the curriculum
- Factors in career choice to design rural training programs
- Relative effectiveness of high- and lowtech simulation in allocating resources



Scholarly Application

- Master the literature
 - Literature reviews (integrations) are critical resources
- Critically appraise the evidence
- Cautious generalization

 Avoid faddishness – "everyone else is doing it"



Generalizing Beyond the Local

- Application is local
- Results, lessons learned, analysis of the evidence, new ideas are generalizable
- Disseminate through workshops, descriptive articles, conferences



Scholarship of Teaching and Learning

systematic study of teaching and learning processes



Examples

- Faculty development
- Curriculum design
- Teaching methods
- Giving feedback
- Correcting misconceptions
- Assessment practices



Domains of Teaching Expertise

Content Expertise

Teaching Expertise

Content Teaching Expertise

Shulman, 1986



What Makes It Scholarship?

- Address a generalizable problem
- Literature context
- Rigor and reproducibility
- Evidence!
- Thoughtful analysis
- Dissemination



Supportive Environment



Institutional Priority

- Scholarly approach to education (like clinical care)
 - Focus on evidence
 - Rigorous questions
- Incorporate research evidence in educational decisions
- Recognizing educational scholarship in promotion and tenure decisions



Research Education

- Faculty development programs
- Workshops in HPE research
 - AAMC Medical Education Research
 Certificate program
 - Online seminars (e.g., IAMSE)
 - Courses at AMEE conference
- Mentoring (if mentors available)
- Masters programs



Technical Support

- Formal Office or Department to support HPER
- Local community of experts and technicians
- Professional societies
- Consortia and collaboratives



Community Building

- Celebration of Health Professions
 Education
- Journal clubs or discussion groups
- Academies and related groups of designated faculty
- Regional, national, and international professional societies (AMEE, AAMC, Asia-Pacific Medical Education Conference, etc.)



Collaborations

- HPER has small numbers at individual schools
- Joining forces across institutions
 - Strength in numbers
 - Complementary strengths
 - Broader perspective (international)
 - E.g., AMA Accelerating Change in Education, Best Evidence Medical Education



In Conclusion...

- Important questions are everywhere, but "good" questions need careful crafting
- HPE scholarship is both very easy and very difficult
 - No special lab or equipment
 - Very complex problems and mechanisms
- Beware the obstacles to HPE scholarship
- Seek and share creative remedies for them

 working together





Elements Common to All Four Types of Scholarship



Scholarship That Makes a Difference

- Investigates important questions
- Connects study to prior research and to theory
- Measures the right thing the right way
- Uses appropriate research design & data analysis procedures
- Disseminates results





- Moving from general issues to specific questions
- Using the literature to refine the question
- Measuring the variables
- Selecting the right study design



Finding the Literature

- Health sciences librarians
- Literature reviews
- Increasing numbers of textbooks in HPE
- Colleagues near and far
- HPE listservs



Measurement Is Essential

- Counting events
- Measuring time and physical quantities
- Externalizing internal (psychological) states, events, and processes





- Most educational outcomes don't have perfect (or even good) measures
- Need to develop new & better measurement tools
 - Reliability
 - Validity
 - Feasibility
 - Utility



Disseminating Med Ed Scholarship

- Specialty journals & meetings
- HPE journals & meetings
 - Academic Medicine, Medical Education, Teaching and Learning in Medicine, Advances in Health Sciences Education, Medical Teacher, ...
 - Assoc. of American Medical Colleges, Ottawa Conference, Assoc. for Medical Education in Europe, ACGME, and many more



Obstacles Common to All Four Types of Scholarship



Conflicting Purposes

- Practical problem solving vs. theory development
- Short-term gains vs. long-term goals
- LPU (Least Publishable Unit) vs. comprehensive study
- Generalist (deal with all problems) vs. specialist (focus on narrow domain)



Study Quality Problems

- Small sample sizes
- Weak interventions
- Many confounding variables
 - Prior experience
 - Other educational interventions
 - Student motivation and goals
 - Free will



Opportunistic Scholarship

- Blessing
 - Easy entrance to med ed scholarship
 - Broadened interest and community
 - Greater quantity of scholarship
- Curse
 - Quality problems
 - Dabbling
 - Shallow and duplicative



Isolationism

- Not considering what has already been done
- Not consulting, contacting, or collaborating with those with similar interests
 - Inside and outside the institution
- Not contributing to or participating in the HPE community



Need for Expert Advice

- Consultations needed for specialized expertise: statistics, design, measurement, theory
- Where to find the consultants
 - School
 - University
 - Professional societies
 - Published authors (most are helpful)



Finding Time & Money

- Faculty are stretched and fragmented
 - Many good ideas get lost in the shuffle or remain unreported
- HPE generally considered an institutional responsibility
 - Institution expected to support research in HPE as well



Ethics Review

- Faculty often don't see their efforts as "research"
- Ethics review board may not consider it "research"
- Educational research doesn't fit many of the cost-benefit dimensions of biomedical research
 - Review board doesn't know how to deal with educational research

