WHAT IS THIS THING CALLED *RIME*?

Geoff Norman
McMaster University
Early History

• SUNY Buffalo 1950s
  – George Miller, Jason, McGuire, Abrahamson

• Jason → Michigan State U
  – Shulman, Elstein, Downing, Bridgeham

• Abrahamson → U Southern California
  – Barrows, Nyquist

• McGuire, Miller → U Illinois Chicago
  – Gordon Page, Bordage, Downing
The 1970’s and PBL

• Problem Based Learning begins at McMaster, 1965
  – PED (now PERD) opens 1971
    • Neufeld, Barrows, --- Norman, Woodward,
• Maastricht adopts PBL 1973
  – Large education group – Schmidt, van der Vleuten
• Other schools (U New Mexico; Linkoping)
The Testing Agencies

• Testing Boards and Evaluation methodologies
• American Board Internal Medicine
  – Webster, Swanson, Norcini
• National Board of Medical Examiners
  – Swanson, Case, LaDuca,
• Medical Council of Canada
  – Bordage, Page, Reznick, Wood, Blackmore
The Three Waves

(Norman GR. Fifty years of medical education research. Med Educ 2011; 45: 785-91)

Wave 1: The misfits (1960—1980)
Folks with unrelated PhDs who muddled through
(Norman, McGuire, Irby, Page, etc).

Wave 2: The specialists (1970 – now)
Folks with PhDs in relevant area (psychology, sociology, psychometrics
(Norcini, Eva, Regehr, van der Vleuten)

Wave 3: The med educ specialists
Folks, usually health professionals, with graduate degree in med educ.
The Players (by Nation)

• Canada

• Netherlands

• USA

• Everyone else
## Top Publications

<table>
<thead>
<tr>
<th>Rank</th>
<th>Institution name</th>
<th>Publication count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Maastricht University, The Netherlands</td>
<td>295</td>
</tr>
<tr>
<td>2</td>
<td>Harvard University, United States</td>
<td>224</td>
</tr>
<tr>
<td>3</td>
<td>University of Toronto, Canada</td>
<td>199</td>
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<tr>
<td>4</td>
<td>University of Washington, United States</td>
<td>184</td>
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<tr>
<td>5</td>
<td>University of California San Francisco, United States</td>
<td>165</td>
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<tr>
<td>6</td>
<td>McMaster University, Canada</td>
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<tr>
<td>7</td>
<td>University of Michigan, United States</td>
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<tr>
<td>8</td>
<td>University of Dundee, United Kingdom</td>
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<td>9</td>
<td>University of Illinois, United States</td>
<td>150</td>
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<tr>
<td>10</td>
<td>University of Texas, United States</td>
<td>143</td>
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</table>
### Top Authors

**Table 3** The ten authors who contributed most articles to the field of medical education 1988–2010

<table>
<thead>
<tr>
<th>Rank</th>
<th>Author</th>
<th>Papers published</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Van der Vleuten, C.P.M., Maastricht University, The Netherlands</td>
<td>171</td>
</tr>
<tr>
<td>2</td>
<td>Scherpplier, A.J.J.A., Maastricht University, The Netherlands</td>
<td>114</td>
</tr>
<tr>
<td>3</td>
<td>Norman, G.R., McMaster University, Canada</td>
<td>71</td>
</tr>
<tr>
<td>4</td>
<td>Harden, R.M., University of Dundee, United Kingdom</td>
<td>69</td>
</tr>
<tr>
<td>5</td>
<td>Dolmans, D.H.J.M., Maastricht University, The Netherlands</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>Schmidt, H.G., Maastricht University and Erasmus University, The Netherlands</td>
<td>42</td>
</tr>
<tr>
<td>7–8</td>
<td>Steinert, Y., McGill University, Canada</td>
<td>41</td>
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<tr>
<td>7–8</td>
<td>Durning, S.J., Uniformed Services University of the Health Sciences, United States</td>
<td>41</td>
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<tr>
<td>9</td>
<td>Irby, D.M., University of California San Francisco, United States</td>
<td>40</td>
</tr>
<tr>
<td>10–11</td>
<td>Hojat, M., Thomas Jefferson University, United States</td>
<td>38</td>
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<tr>
<td>10–11</td>
<td>Regehr, G., University of Toronto, Canada</td>
<td>38</td>
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</table>
# Top Citations

<table>
<thead>
<tr>
<th>Rank</th>
<th>Author</th>
<th>Number of times cited</th>
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<tbody>
<tr>
<td>1</td>
<td>Norman, G.R., McMaster University, Canada</td>
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<td>Regehr, G., University of Toronto, Canada</td>
<td>3,387</td>
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<td>3</td>
<td>Schmidt, H.G., Maastricht University and Erasmus University, The Netherlands</td>
<td>2,802</td>
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<td>4</td>
<td>Van der Vleuten, C.P.M., Maastricht University, The Netherlands</td>
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<td>5</td>
<td>Irby, D.M., University of California San Francisco, United States</td>
<td>2,214</td>
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<tr>
<td>6</td>
<td>Shea, J.A., University of Pennsylvania, United States</td>
<td>1,876</td>
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<td>7</td>
<td>Whitcomb, M.E., Wesleyan University, United States</td>
<td>1,756</td>
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<td>8</td>
<td>Colliver, J.A., Southern Illinois University, United States</td>
<td>1,616</td>
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<td>9</td>
<td>Harden, R.M., University of Dundee, United Kingdom</td>
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<td>10</td>
<td>Hojat, M., Thomas Jefferson University, United States</td>
<td>1,228</td>
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</table>
# Hubbard Award Recipients

<table>
<thead>
<tr>
<th>Recipient</th>
<th>Year</th>
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<tbody>
<tr>
<td>Larry D. Gruppen, PhD 2015</td>
<td>2015</td>
</tr>
<tr>
<td>Robyn Tamblyn, BScN, MSc, PhD</td>
<td>2014</td>
</tr>
<tr>
<td>Kevin W. Eva, PhD</td>
<td>2013</td>
</tr>
<tr>
<td>Brian David Hodges, MD, PhD</td>
<td>2012</td>
</tr>
<tr>
<td>Judy A. Shea, PhD</td>
<td>2011</td>
</tr>
<tr>
<td>Maxine A. Papadakis, MD</td>
<td>2010</td>
</tr>
<tr>
<td>John J. Norcini, PhD</td>
<td>2009</td>
</tr>
<tr>
<td>Dame Lesley Southgate</td>
<td>2008</td>
</tr>
<tr>
<td>Glenn Regehr, PhD</td>
<td>2007</td>
</tr>
<tr>
<td>Reed G. Williams, PhD</td>
<td>2006</td>
</tr>
<tr>
<td>Cees P.M. van der Vleuten, PhD</td>
<td>2005</td>
</tr>
<tr>
<td>David L. Nahrwold, MD</td>
<td>2003</td>
</tr>
<tr>
<td>Susan M. Case, PhD</td>
<td>2002</td>
</tr>
<tr>
<td>David M. Irby, PhD</td>
<td>2001</td>
</tr>
<tr>
<td>Richard K. Reznick, MD</td>
<td>2000</td>
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<tr>
<td>Paul G. Ramsey, MD</td>
<td>1999</td>
</tr>
<tr>
<td>Mark A. Albanese, PhD</td>
<td>1998</td>
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<tr>
<td>W. Dale Dauphinee, MD</td>
<td>1997</td>
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<tr>
<td>David I. Newble, MD</td>
<td>1997</td>
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<tr>
<td>Ian R. Hart, MB, ChB</td>
<td>1996</td>
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<tr>
<td>Jerry A. Colliver, PhD</td>
<td>1995</td>
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<tr>
<td>Georges Bordage, MD, PhD</td>
<td>1994</td>
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<td>John W. Williamson, MD</td>
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<td>Ronald M. Harden, MD</td>
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<td>Arthur S. Elstein, PhD</td>
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<td>Paula L. Stillman, MD</td>
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<td>Geoffrey R. Norman, PhD</td>
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<td>Christine H. McGuire, MA</td>
<td>1987</td>
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<tr>
<td>Stephen Abrahamson, PhD</td>
<td>1986</td>
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<tr>
<td>George E. Miller, MD</td>
<td>1985</td>
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<tr>
<td>Howard S. Barrows, MD</td>
<td>1984</td>
</tr>
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</table>
Karolinka Awards

• 2014  John Norcini
• 2012  Cees van der Vleuten
• 2010  Richard Reznick / Dave Irby
• 2008  Geoff Norman
• 2006  Ron Harden
• 2004  Henk Schmidt
RESEARCH TRADITIONS

• QUANTITATIVE
  – Experimental
  – Psychometric
  – Epidemiological
  – Correlational

• QUALITATIVE
  – (no comment)

• REVIEW
  – Systematic
  – Critical
THE EXPERIMENTAL TRADITION

- Randomize to 2 or more groups
- Intervention under experimental control
- Frequently theory-testing
The value of basic science in clinical diagnosis: creating coherence among signs and symptoms

Nicole N Woods, Lee R Brooks & Geoffrey R Norman

BACKGROUND We investigated whether learning basic science mechanisms may have mnemonic value in helping students remember signs and symptoms, in comparison with learning the relation between symptoms and diagnoses directly.

PURPOSE To compare 2 approaches to learning diagnosis: learning how features of various conditions relate to underlying pathophysiological mechanisms and learning the conditional probability of diagnoses.

Medical Education 2005; 39: 107–112
doi:10.1111/j.1365-2929.2004.02036.x

INTRODUCTION

Medical students spend a minimum of 2 years studying basic science. Paradoxically, although educators may believe that this is a necessary foundation for clinical medicine, studies of clinician reasoning have
• Goal:
  – Role of basic science in enhancing coherence of symptoms and diseases
• Methods
  – Four neurological diseases
    • Muscle Disorders
    • Neuromuscular Junction Disorders
    • Upper Motor Neuron Lesions
    • Lower Motor Neuron Lesion
  – 18 features / category
  – 36 undergrad psych students
- Basic Science or Sympt x Disease probability
Score on Dx Test

Graph showing score on Dx Test with Immediate and 1 Week scores. The graph compares features and basic science scores.
The Relative Effectiveness of Computer-Based and Traditional Resources for Education in Anatomy

Zaid Khot,1 Kaitlyn Quinlan,2 Geoffrey R. Norman,3* Bruce Wainman4

1Schulich School of Medicine and Dentistry, the University of Western Ontario, London, Ontario, Canada
2School of Physical Therapy, the University of Western Ontario, London, Ontario, Canada
3Department of Clinical Epidemiology and Biostatistics, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada
4Department of Pathology and Molecular Medicine, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada

There is increasing use of computer–based resources to teach anatomy, although no study has compared computer-based learning to traditional. In this study, we examine the effec-
Khot, Wainmanman, Norman 2103

• “Real” Virtual Reality vs. Two view vs. Real Reality (plastic pelvis)
  – 3 groups n = 20 undergrad
  – 20 nominal questions
  – Test on real skeletal pelvis
Percent correct

- Plastic Model: 70%
- Key Views: 40%
- Virtual reality: 40%
THE PSYCHOMETRIC TRADITION

• Devise assessment instrument

• Reliability
  – Administer on multiple observations (rater, time, version etc.)

• Validity
  – Correlate with external variable (other measure, demographic, personal characteristics)
The Ability of the Multiple Mini-Interview to Predict Preclerkship Performance in Medical School

Eva, Kevin W.; Reiter, Harold I.; Rosenfeld, Jack; Norman, Geoffrey R.

Abstract

Problem Statement and Background. One of the greatest challenges continuing to face medical educators is the development of an admissions protocol that provides valid information pertaining to the noncognitive qualities candidates possess. An innovative protocol, the Multiple Mini-Interview, has recently been shown to be feasible, acceptable, and reliable. This article presents a first assessment of the technique's validity.

Method. Forty five candidates to the Undergraduate MD program at McMaster University participated in an MMI in Spring 2002 and enrolled in the program the following autumn. Performance on this tool and on the traditional protocol was compared to performance on preclerkship evaluation exercises.

Results. The MMI was the best predictor of objective structured clinical examination performance and grade point average was the most consistent predictor of performance on multiple-choice question examinations of medical knowledge.

Conclusions. While further validity testing is required, the MMI appears better able to predict preclerkship performance relative to traditional tools designed to assess the noncognitive qualities of applicants.
The Ability of the MMI to Predict Preclerkship Performance

• 45 students
• Measures of:
  – ADMISSIONS IN COURSE
    Auto Letter
    GPA
    MMI
    Interview
  – Multiple Choice Exam
  – OSCE
  – Sim Tutorial
Correlation with Criterion

-30  -20  -10   0   10   20   30   40   50   60

Auto letter  GPA  MMI  Interview  Sim Tut

OSCE  MCQ
THE EPIDEMIOLOGIC TRADITION

• Typically designed to examine “risk factors” for future behaviour
  – E.g. Admissions variables
  – In-course assessments
  – Certification examinations
  – Performance in practice
Physician Scores on a National Clinical Skills Examination as Predictors of Complaints to Medical Regulatory Authorities

Robyn Tamblyn, PhD; Michal Abrahamowicz, PhD; Dale Dauphinee, MD; Elizabeth Wenghofer, PhD; André Jacques, MD; Daniel Klass, MD; Sydney Smee, MSc; David Blackmore, PhD; Nancy Winslade, PharmD; Nadyne Girard, MSc; Roxane Du Berger, MSc; Ilona Bartman, MA; David L. Buckeridge, MD, PhD; James A. Hanley, PhD

Tamblyn et al. (2007)
Licensing Exam Score Board and Complaints to Regulatory

- 3424 MDs, licensing exam 1993-1996

- practice in Ontario & Quebec

- Complaint to reg body (n = 696)
Written

MCQ
CDM
Comm
Probl
Solv

OSCE

Comm Comp
QofC Comp
THE CORRELATIONAL TRADITION

• Assemble a number of variables on a number of people
  – From surveys (satisfaction, perceived learning)
  – Demographics (age, gender)
  – Aptitude, achievement

• Examine relations among them
  – Correlations
  – Regression
  – Factor Analysis
  – Structural Equation Modelling
Importance of tutor characteristic by student achievement

![Bar chart showing the importance of various tutor characteristics by student achievement. The chart includes expertise, social congruence, and cognitive congruence, with categories for high, medium, and low.]
SYSTEMATIC REVIEWS AND CRITICAL REVIEWS

• SYSTEMATIC - Does it work?
  – Systematic and comprehensive literature search
  – Explicit criteria to accept/reject
  – Quantitative summary (Effect Size)

• CRITICAL – How does it work?
  – Less explicit search strategy
  – Careful verbal analysis and synthesis
Systematic Review

(Cook et al, JAMA 2008; 300: 1181-1196)

Effect of Learning Technology (Internet Learning) in Health Sciences
Effect of Learning Technology (Internet Learning) in Health Sciences

(Cook et al, JAMA 2008; 300: 1181-1196)

2190 studies

214 appropriate

130 No Intervention Control

76 Non-Internet Control
No Intervention

![Bar chart showing comparison between Knowledge, Skills, and Outcomes with Knowledge having the highest value.](chart.png)
Alternative Intervention

Knowledge: p=.04
Skills: ns
Outcomes: ns
Satisfaction: ns
CRITICAL REVIEW

RESOURCES

• QUANTITATIVE
  – Norman GR, Eva KW. Quantitative research Methods in Medical Education.

• QUALITATIVE
  – Lingard L, Kennedy T. Qualitative research Methods in Medical Education.

ASME “UNDERSTANDING MEDICAL EDUCATION” SERIES, 2015
### MOST CITED ARTICLES

The themes, institutions, and people of medical education research

**Table 4** The ten most cited articles in the field of medical education 1988–2010

<table>
<thead>
<tr>
<th>Rank</th>
<th>Article</th>
<th>Times cited</th>
</tr>
</thead>
</table>
Broader Issues

• What kind of research is most popular?

• What kind of research is most valued?
<table>
<thead>
<tr>
<th>Rank</th>
<th>Categories</th>
<th>Overall count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Issues in student assessment</td>
<td>1559</td>
</tr>
<tr>
<td>2</td>
<td>Clinical skills training</td>
<td>1303</td>
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<tr>
<td>3</td>
<td>Clinical clerkships</td>
<td>1218</td>
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<tr>
<td>4</td>
<td>Problem-based learning</td>
<td>731</td>
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<tr>
<td>5</td>
<td>Community-based-based training</td>
<td>594</td>
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<td>6</td>
<td>Clinical competence assessment</td>
<td>529</td>
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<td>7</td>
<td>Teaching the clinical sciences</td>
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<tr>
<td>8</td>
<td>Communication skills training</td>
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<tr>
<td>9</td>
<td>Student characteristics</td>
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<tr>
<td>10</td>
<td>Objective structured clinical examination</td>
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<tr>
<td>11</td>
<td>Teaching the basic sciences</td>
<td>299</td>
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<tr>
<td>12</td>
<td>Nature of clinical reasoning</td>
<td>248</td>
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<tr>
<td>13</td>
<td>Professionalism in medicine</td>
<td>236</td>
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<tr>
<td>14</td>
<td>Costs of medical education</td>
<td>236</td>
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<tr>
<td>15</td>
<td>Faculty development</td>
<td>189</td>
</tr>
<tr>
<td>16</td>
<td>Use of simulations</td>
<td>160</td>
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<tr>
<td>17</td>
<td>Admission to medical school</td>
<td>107</td>
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<tr>
<td>18</td>
<td>Medical licensing examination</td>
<td>88</td>
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<tr>
<td>19</td>
<td>Knowledge retention</td>
<td>84</td>
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<tr>
<td>20</td>
<td>Specialty choice</td>
<td>68</td>
</tr>
</tbody>
</table>
The Cook – Schmidt Framework

• DESCRIPTION (What is it?)
  – Simple description of innovation (curriculum, assessment, technology), with maybe satisfaction measure

• JUSTIFICATION (Does it work?)
  – Demonstration that the innovation is as or more effective than a comparator

• CLARIFICATION (Why does it work?)
  – Experimental manipulation of causal factors
Research Journals

Medical Education    ASME(UK)    12/yr
Academic Medicine    AAMC(US)    12/yr
Adv. Health Science Educ    5/year
Medical Teacher    AMEE       12/yr
Teach Learn Med US    4/yr

***

Anatomical Science Education
Medical Science Educator
J    Journal of Postgraduate Education
## Achievements from 30 Years of Medical Education Research

- **Survey of AHSE editors (n = 15)**
  - 1) Assessment: 11
  - 2) Clinical Reasoning: 8
  - 3) Content specificity: 5
  - 4) Simulation: 4
  - 5) Science of Teaching and Learning: 4
- Progress as a Discipline: 4
Assessment and the Licensing Bodies (11)

- U.S. and Canada licensing bodies
  - NBME, ABIM, Medical Council Canada

Major role in advancing “state of the art” in assessment
- New assessment methods (OSCE, Q4)
- International recognition (Hubbard)
- Grant programs (MCC, Stemmler)
- FAIMER (from ABIM)
Clinical Reasoning

• From “Clinical Reasoning Skills (ca. 1975)
• To “Dual Process Models”
  – Analytic / Non-analytic
  – Fuzzy Trace
  – System 1 / System 2
• Explicit recognition of two kinds of knowledge
  – Formal / tacit or analytic / experiential
• Implication for Instruction and Practice
Content Specificity

• Whatever you measure / however you measure it
  - The correlation across observations (problems, samples) is 0.1 to 0.3
  - Assessment methods like OSCE, MMI, MCQ
  - Decline of “skills” (Problem-solving, critical thinking, self-assessment)
Simulation

• Recognition of potential but essential role of simulation in education

• From focus on “Fidelity” to critical task analysis

• Insufficient integration at curriculum level
Science of Teaching and Learning

• Fundamental understanding of the nature of human learning
  – Based on STWM – LTAM
• Implication (unfulfilled?) for instruction
The Evolution and Maturation of the Discipline of MER

- Increased sophistication of the Journals
  - Low acceptance rate
  - Increased impact factor
  - Greater theory focus

- Increased numbers of participants
  - PhD with expertise in social / behavioral science
  - MD with advanced training

- Increased educational opportunities
  - FAIMER
  - Maastricht, UIC, Dundee, Wilson, Erasmus
CHALLENGES FOR THE FUTURE
CHALLENGES FOR THE FUTURE

• Can Competency Based / Outcome Based Education deliver?

• How can we integrate simulation into the curriculum at UGME and PGME?

• Broadening admissions to assess “non-cognitive” factors
Can Competency Based Education deliver?

• To date, many descriptions of CBE, many countries adopting it.
• Operationalizing create hundreds of assessable objectives
• One (?) demonstration, structured on basic surgical skills (Reznick)
• Some evidence that assessment, using CANMeds roles, has problems
• Massive issues in assessing EPAs
  – Norman, Bordage, Norcini, 2013
Integrating simulation into the curriculum

• With changes in health care, need to use simulation
• To date, models are expensive, complicated
• Need to create simulations that are based on careful analysis of critical behaviours
  – E.g. IV insertion
• Need to create curricula integrating simulator
  – E.g. Mixedpractice for diagnosis
Broadening admissions process

• Good assessment of cognitive achievement
  – MCAT 2105, GAMSAT, etc.

• Some assessment of “non-academic factors”
  – MMI, CASPer.

• Not clear what is “non-academic factor”?
  – Is it skills? (Communication)
  – Is it personality (conscientiousness)
  – Is it attitudes (motivation, altruism)
CONCLUSIONS

• MEDICAL EDUCATION RESEARCH IS:
  – Progressive
  – Scientifically credible
  – Practically important
  – Valued by the medical community