

**Translational Science and Validity in Medical Education:
Insights from Workplace-Based Assessments and
Assessment Systems**

University of Tokyo
Medical Education Lecture

Yoon Soo Park, PhD
December 21, 2017

Overview

1. Overview of **Validity** and **Translational Science**
2. **Validity Study**
 - End-of-rotation evaluation (UI- College of Medicine)
 - Blood transfusion training (Regional Hospital, Iowa)
 - Medical Licensing Examination (Canada)
3. **Translational science**
 - Central venous catheter (CVC) insertion
 - Other Examples
4. **Implications**

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Goals for Medical Education

- Equip physicians with knowledge, skills, attributes
- Deliver **quality patient care**

Classroom Education → Quality Patient care

• Effective
• Efficient
• Economical

- Educate **“superior”** clinicians
- Improve **patient outcomes**

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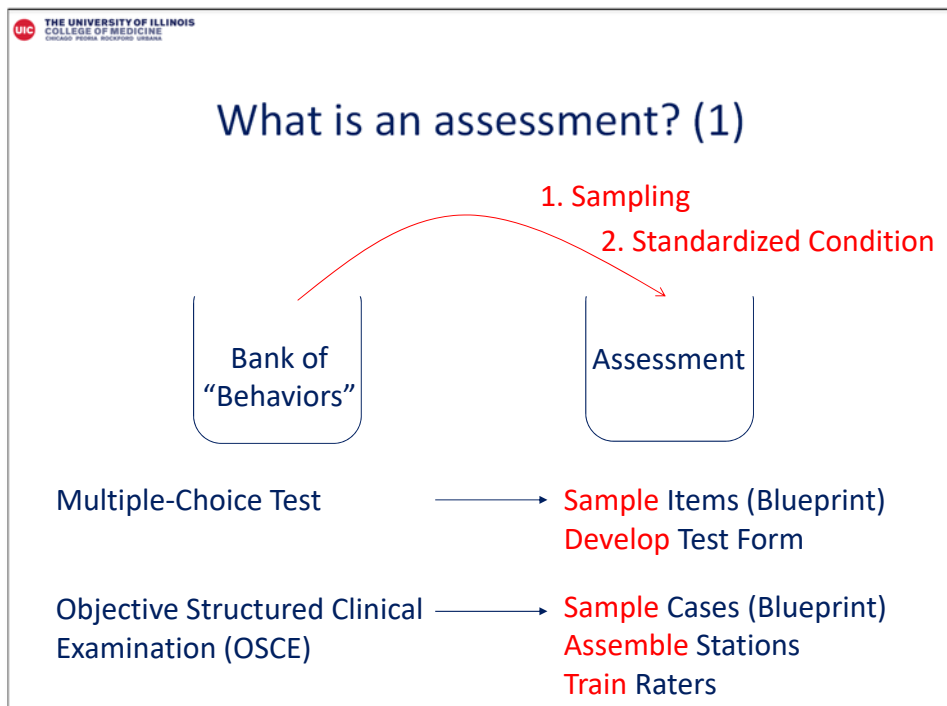
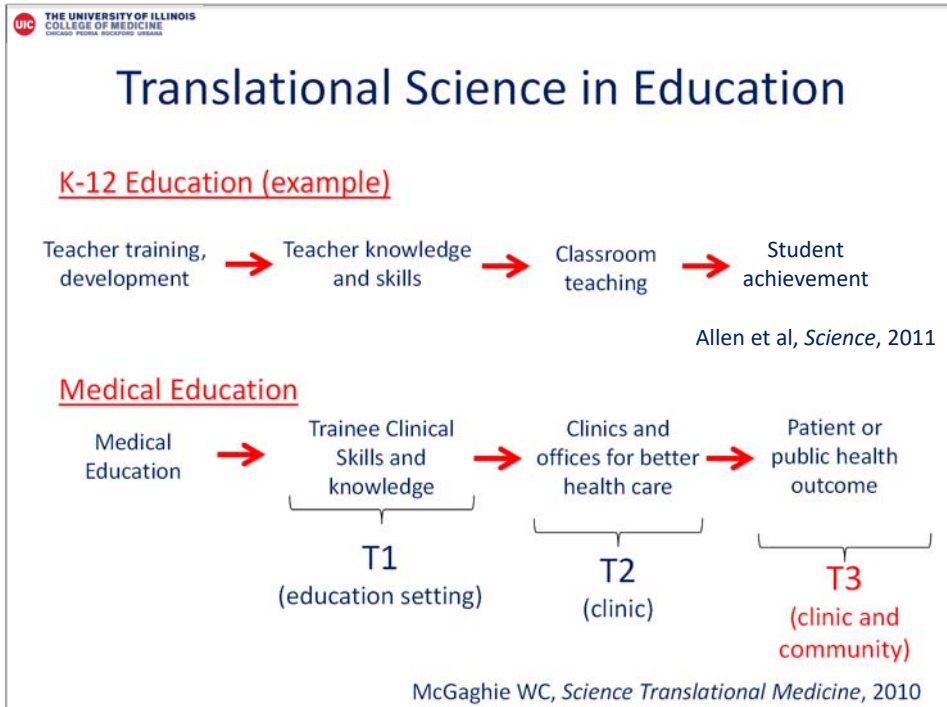
Translational Science

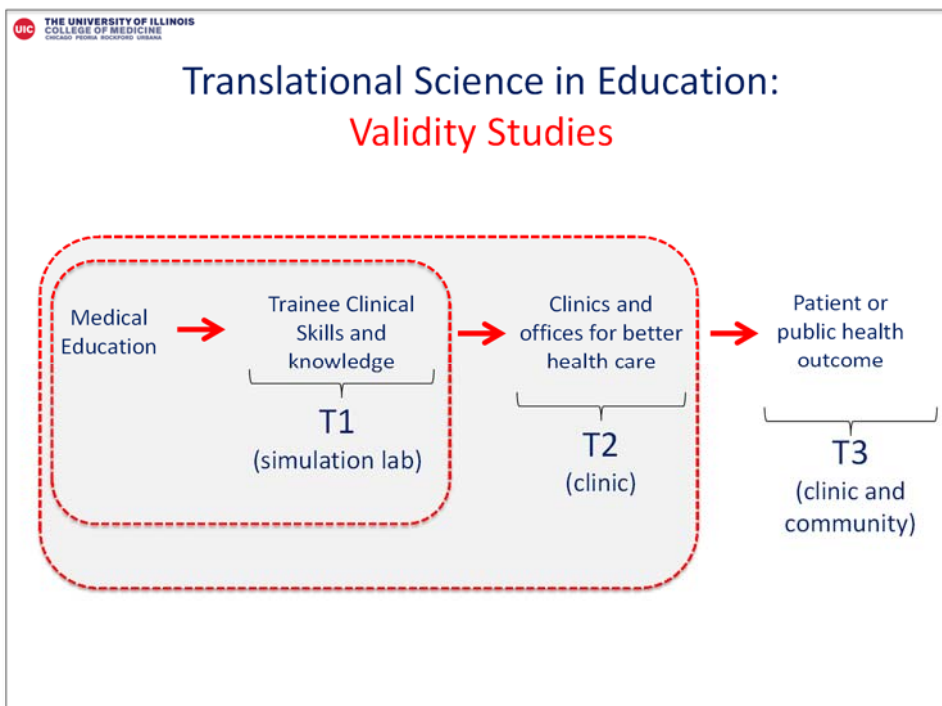
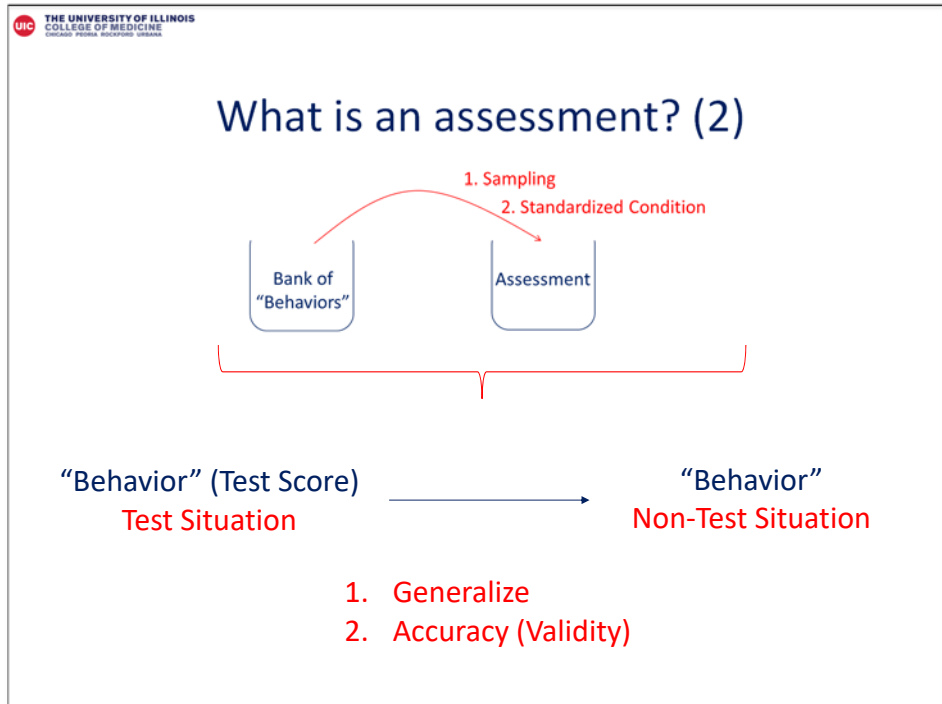
- **Bench-to-bedside** transition
- *Translation* of knowledge **to new treatment for patients**
- *Translating* research **to practice**

Basic Laboratory Discovery in Biomedical Science → Clinical Research → Evidence of clinical effectiveness
Identify effective treatment
Policy → Healthcare delivery
Community engagement
Preventive services

T1 T2 T3

Woolf SH, *JAMA*, 2008





Applied Validity Studies:

T1 and T2: End-Of-Rotation Evaluations

Park et al, *Medical Education*, 2014

Park et al, *Teaching and Learning in Medicine*, 2016

T3: Blood Transfusion Training

Porteous, Park, et al, *Journal of Hospital Medicine*, 2015

Validity Studies: T1/T2 and T3

T1: Feedback based on rating instrument

- Improvement in competencies through feedback

T2: Problem residents

- Early detection of low-performing physicians
- Issues in professional behavior
- Probation status
- Impact on hospital system


T3: Blood transfusion training

- Reduce unnecessary blood transfusion
- Cost savings



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Validity Studies: T1 and T2

ASME **medical education**
www.mededuc.com
Explore this journal >

Assessment
Validity evidence of resident competency ratings and the identification of problem residents
Yoon Soo Park , Janet Riddle, Ara Tekian
First published: 8 May 2014 Full publication history
DOI: 10.1111/medu.12408 View/save citation

Journal
Teaching and Learning in Medicine >
An International Journal
Volume 28, 2016 - Issue 2

Validation
Competency Evaluations in the Next Accreditation System: Contributing to Guidelines and Implications
Yoon Soo Park , Fred A. Zar, John J. Norcini & Ara Tekian
Pages 135-145 | Received 29 Jun 2015, Accepted 19 Nov 2015, Accepted author version posted online 03 Feb 2016, Published online 05 Feb 2016
Download citation | <https://doi.org/10.1080/10401334.2016.1146607> 

T1: Feedback based on rating instrument
T2: Problem residents

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Workplace-Based Assessment (1)


- Assessment → **clinical environment**
 - Structured Clinical Observation (SCO)
 - End-of-Rotation Evaluation

Structured Clinical Observation (SCO)

clinical environment

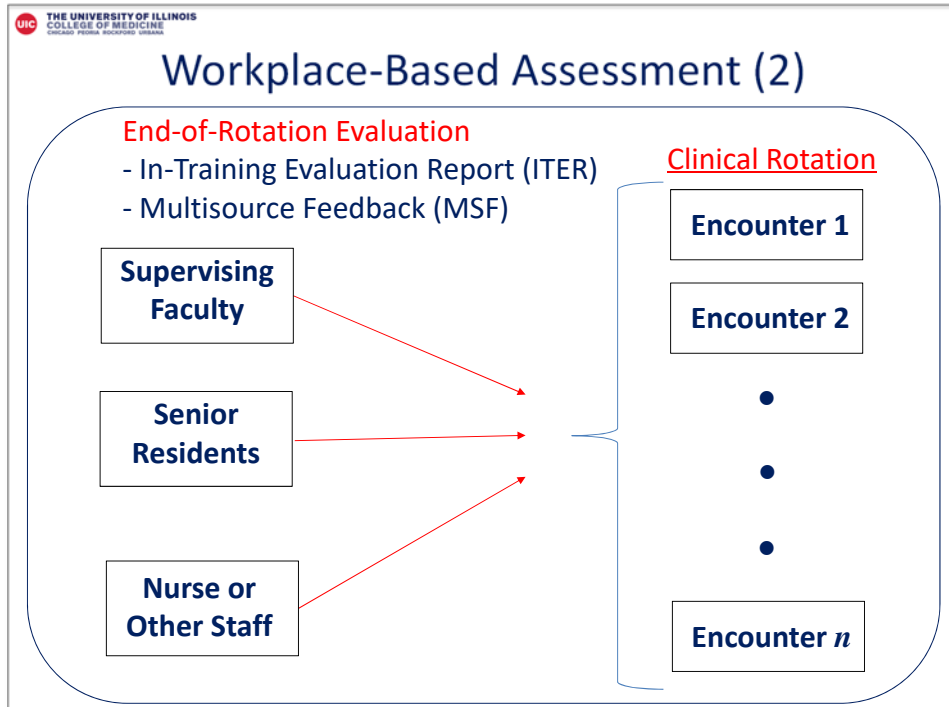
Supervising Faculty

Direct Observation



Resident / Student

Example: History Taking and Physical Examination



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Workplace-Based Assessment (3)

Mini-Clinical Evaluation Exercise (CEX)

Evaluator: _____ Date: _____

Resident: _____ R-1 R-2 R-3

Patient Problem/Dx: _____

Setting: Ambulatory In-patient ED Other _____

Patient: Age: _____ Sex: _____ New Follow-up

Complexity: Low Moderate High

Focus: Data Gathering Diagnosis Therapy Counseling

<p>1. Medical Interviewing Skills (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR	<p>3. Humanistic Qualities/Professionalism</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR
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1 2 3	4 5 6	7 8 9											
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<p>2. Physical Examination Skills (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR	<p>4. Clinical Judgment (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR
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	<p>5. Counseling Skills (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR						
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UNSATISFACTORY	SATISFACTORY	SUPERIOR											
	<p>6. Organization/Efficiency (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR						
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	<p>7. Overall Clinical Competence (○ Not observed)</p> <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%; text-align: center;">1 2 3</td> <td style="width: 33%; text-align: center;">4 5 6</td> <td style="width: 33%; text-align: center;">7 8 9</td> </tr> <tr> <td style="text-align: center;">UNSATISFACTORY</td> <td style="text-align: center;">SATISFACTORY</td> <td style="text-align: center;">SUPERIOR</td> </tr> </table>	1 2 3	4 5 6	7 8 9	UNSATISFACTORY	SATISFACTORY	SUPERIOR						
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End-of-Rotation Evaluation (1)

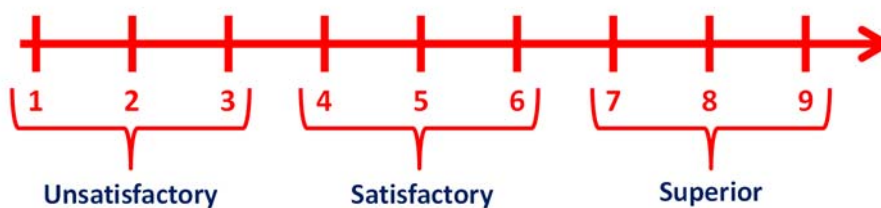
- **Global judgments** completed by supervisors
- Prolonged observation of a resident
- Can include **second-hand reports** and **case presentations**
- Lack of empirical evidence
 - Reproduce **consistent scores**
 - **T1**: Represent **growth** in performance over time
 - **T2**: Identify **problem residents** during early stages of training

End-of-Rotation Evaluation (2)

ACGME core competencies

1. Interpersonal and communication skills
2. Medical knowledge
3. Patient care
4. Practice-based learning and improvement
5. Professionalism
6. System-based practices

End-of-Rotation
Evaluation



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End-Of-Rotation Evaluations: **NAS**

PC2: Develops and achieves comprehensive management plan for each patient

2. Develops and achieves comprehensive management plan for each patient. (PC2)

Critical Deficiencies			Ready for unsupervised practice	Aspirational
Care plans are consistently inappropriate or inaccurate	Inconsistently develops an appropriate care plan	Consistently develops appropriate care plan	Appropriately modifies care plans based on patient's clinical course, additional data, and patient preferences	Role models and teaches complex and patient-centered care
Does not react to situations that require urgent or emergent care	Inconsistently seeks additional guidance when needed	Recognizes situations requiring urgent or emergent care	Recognizes disease presentations that deviate from common patterns and require complex decision-making	Develops customized, prioritized care plans for the most complex patients, incorporating diagnostic uncertainty and cost effectiveness principles
Does not seek additional guidance when needed		Seeks additional guidance and/or consultation as appropriate	Manages complex acute and chronic diseases	

1 **2** **3** **4** **5** **6** **7** **8** **9**
Level "1" **Level "2"** **Level "3"** **Level "4"** **Level "5"**
Critical Deficiencies **Ready for Unsupervised Practice** **Aspirational**

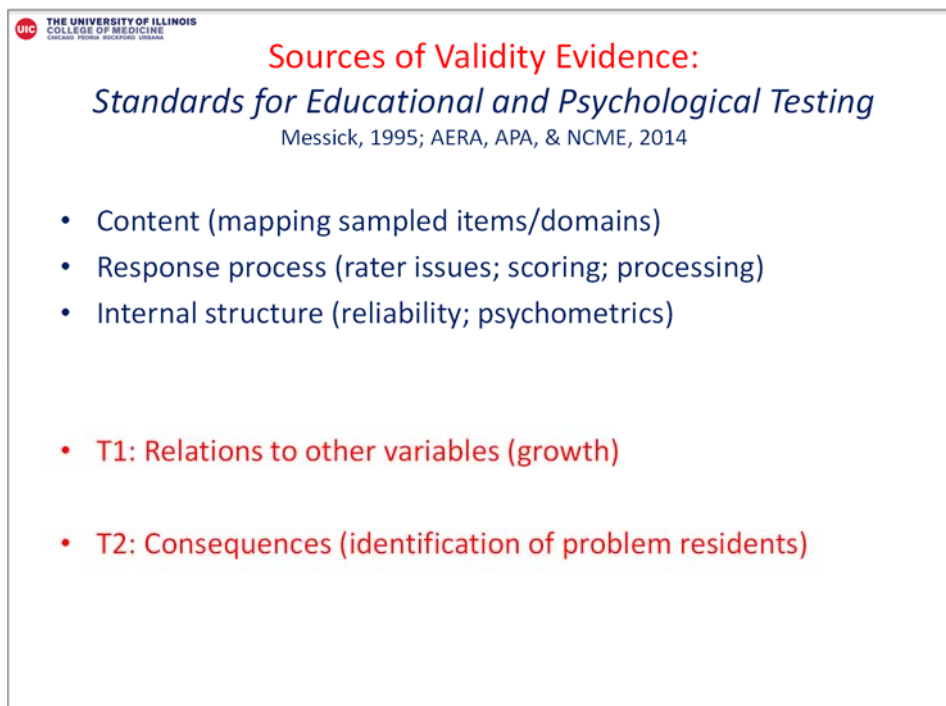
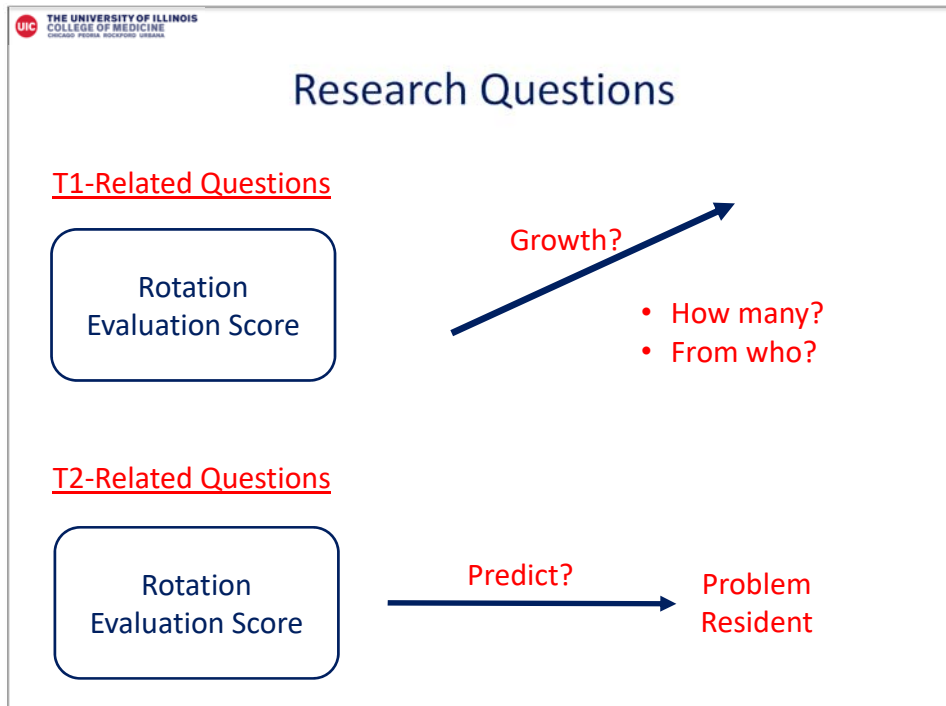
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Anesthesiology Milestones: Example

PC2: Anesthetic Plan and Conduct

Patient Care 2: Anesthetic Plan and Conduct					
Has not Achieved Level 1	Level 1	Level 2	Level 3	Level 4	Level 5
	Formulates patient care plans that include consideration of underlying clinical conditions, past medical history, and patient, medical, or surgical risk factors.	Formulates anesthetic plans for patients undergoing routine procedures that include consideration of underlying clinical conditions, past medical history, patient, anesthetic, and surgical risk factors, and patient choice.	Formulates anesthetic plans for patients undergoing common subspecialty procedures that include consideration of medical, anesthetic, and surgical risk factors, and that take into consideration a patient's anesthetic preference.	Formulates and tailors anesthetic plans that include consideration of medical, anesthetic, and surgical risk factors and patient preference for patients with complex medical issues undergoing complex procedures with conditional independence.	Independently formulates anesthetic plans that include consideration of medical, anesthetic, and surgical risk factors, as well as patient preference, for complex patients and procedures.
	Adapts to new settings for delivery of patient care.	Conducts routine anesthetics, including management of commonly encountered physiologic alterations associated with anesthetic care, with indirect supervision.	Conducts subspecialty anesthetics with indirect supervision, but may require direct supervision for more complex procedures and patients.	Conducts complex anesthetics with conditional independence; may supervise others in the management of complex clinical problems.	Conducts complex anesthetic management independently.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comments:					

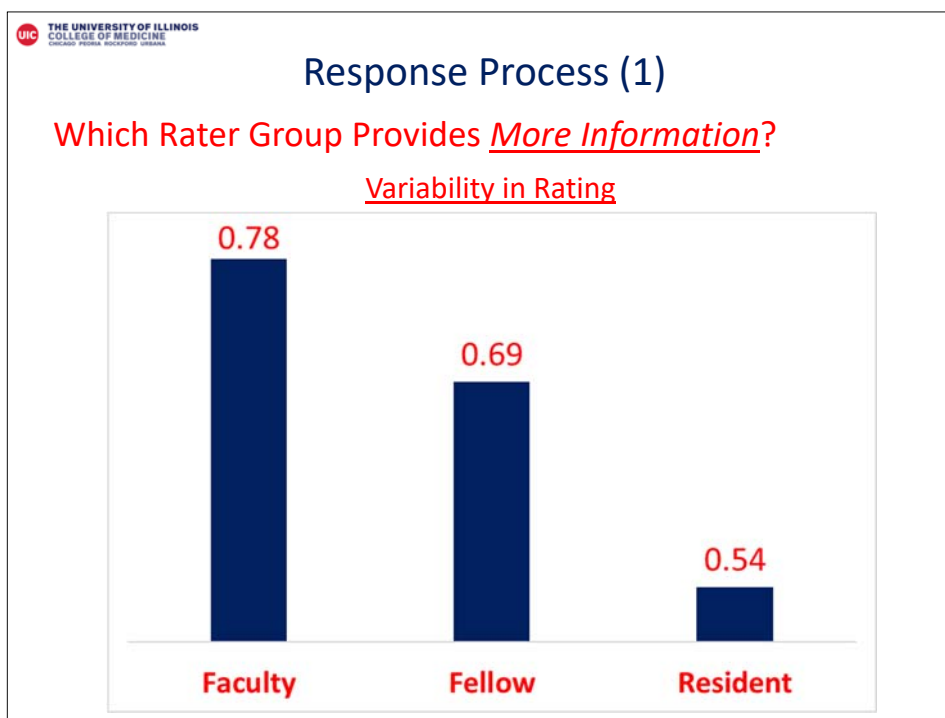
Patient Care (PC): 10
Medical Knowledge (MK): 1
System-Based Practice (SBP): 2
Practice-Based Learning and Improvement (PBLI): 4
Professionalism (PROF): 5
Interpersonal and Communication Skills (ICS): 3

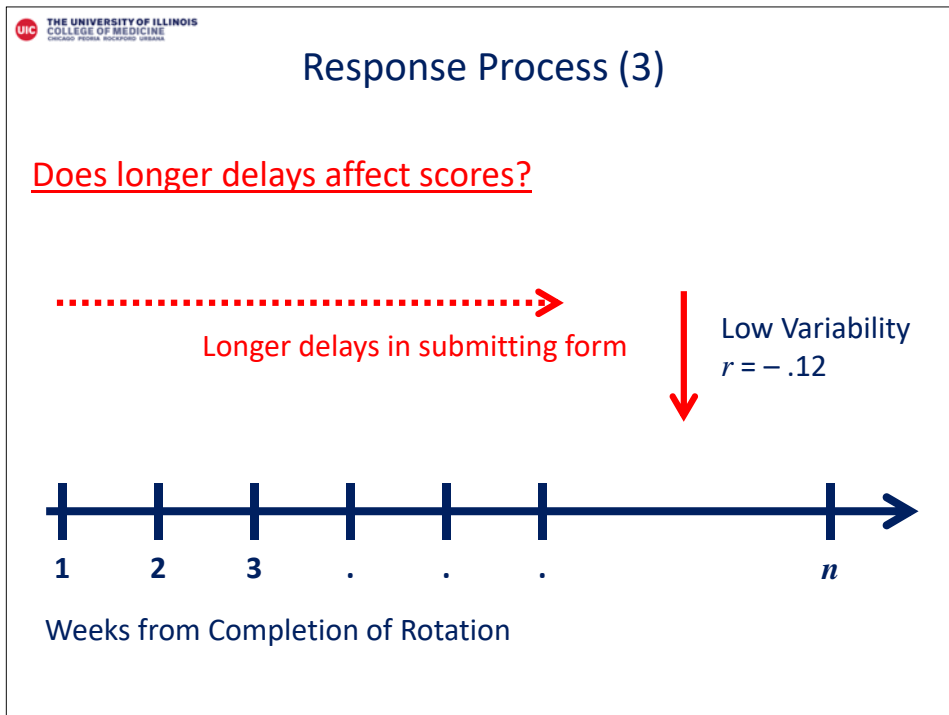
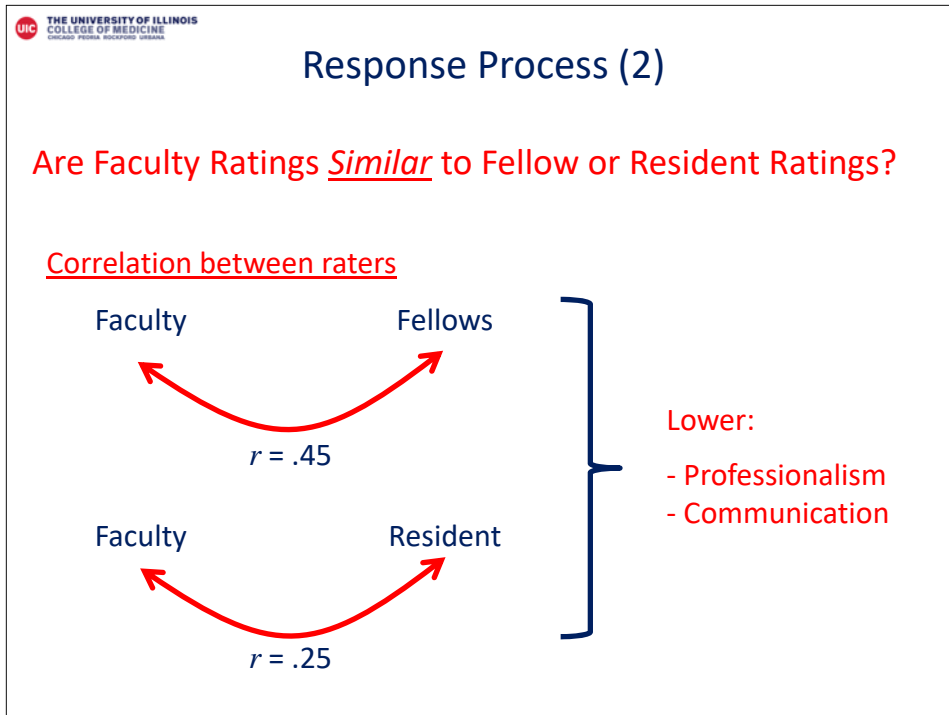


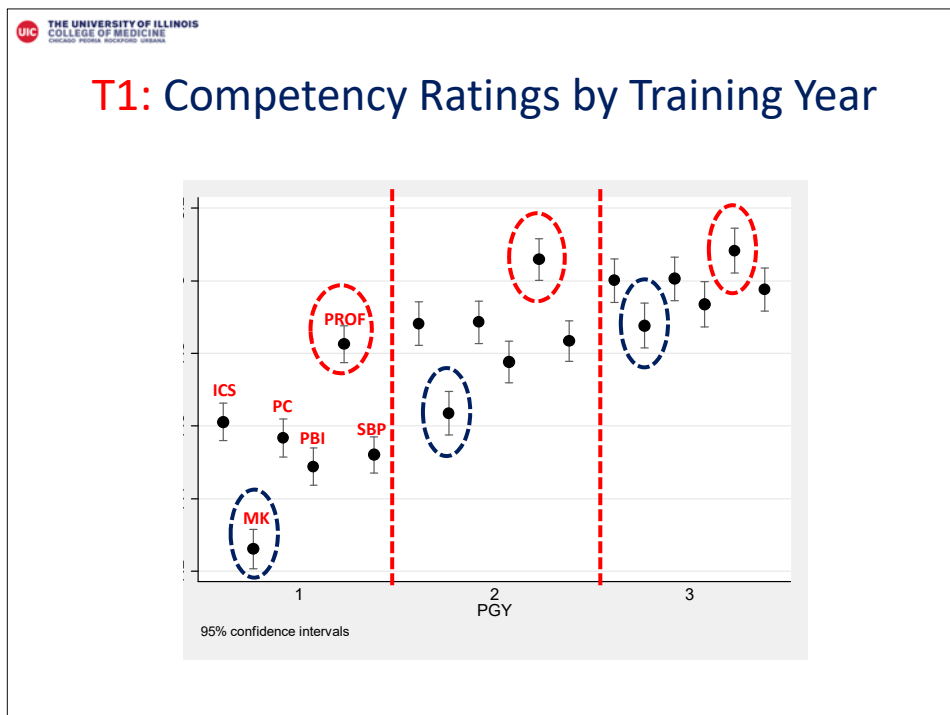
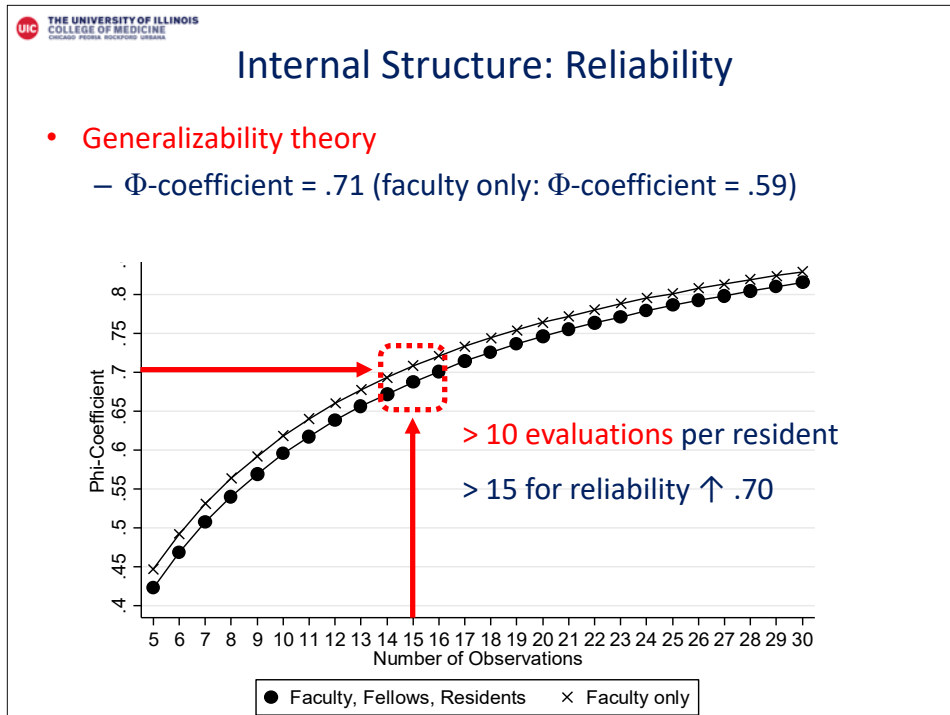
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Data

- **Learners**
 - Internal Medicine: 433 residents (2009 to 2014)
- **Number of evaluations**
 - 7,687 evaluations
- **Evaluators**
 - 146 fellows
 - 144 faculty
 - 21 program directors







T2: Identify Problem Learners

Rotation Evaluation Score $\xrightarrow{\text{OR} = 5.15, p < .001}$ Problem Resident

- **Problem residents:** 14 residents
 - Professional behavior, medical knowledge, motivation
 - Problem residents mean ratings $< 2 - 3$ SDs other residents
- **Similar trend: Anesthesiology** (Turner et al, *Anesthesiology*, 2016)
 - Deficiency in competency (ethical, honesty, respectful behavior)
 - lower graduation and board certification

Assessment system $\xrightarrow{\hspace{2cm}}$ **Clinical Competency Committee**

- Assessment scores (e.g., USMLE)
- Conference attendance
- Qualitative comments
- Scholarly activity
- End-of-rotation evaluations

Subcompetency

- "Level 1"
- "Level 2"
- "Level 3"
- "Level 4"
- "Level 5"

Impact on CCC Decisions

Component	Correlation with CCC reported milestone levels
MK	0.57
PC	0.54
PBLI	0.45
PROF	0.34
SBP	0.29
ICS	0.27

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Blood Transfusion Alert System (1)

shm
Society of Hospital Medicine

Using an Evidence Based Computerized Clinical Decision Alert to Reduce Unnecessary Blood Transfusions in Stable Hospitalized Patients and Increase Cost Savings Associated with Needless Blood Transfusion

Hidalgo Porteros, MD¹; Yoon Soo Park, PhD²; Sarah Marsh, MS, RD³; Jessica Bailey, BSN, RN⁴ and Ethen Mangione, MD⁵

- **Blood transfusion alert system**
 - 423 patients (1,031 units of blood transfused)
 - January 2013 to September 2014
 - Regional Hospital, Iowa, USA
- **Training of hospital staff** on using the alert system

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Blood Transfusion Alert System (2)

- **Training of hospital staff** on using the alert system

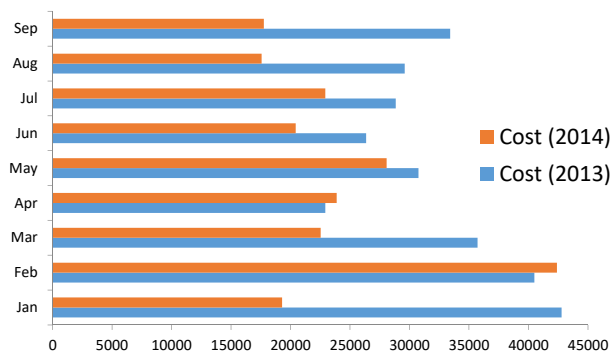
Month	Total Transfusion Orders Each Month (2013)	Total Transfusion Orders Each Month (2014)
Jan	225	100
Feb	225	225
Mar	190	120
Apr	125	125
May	165	150
Jun	140	110
Jul	155	125
Aug	155	95
Sep	180	95

Blood Transfusion Alert System (3)

- Training based on **clinical practice guidelines**
- Develop **clinical decision alert system**
- **T3: Reduction** in unnecessary multiple transfusions per patient
 - **14% reduction** in unnecessary blood transfusions
 - Significant ↓ in **multiple** transfusions per patient

Blood Transfusion Alert System (4)

- **T3: Net Savings of \$36,863!**



- Result of **simple training**

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T2 Example: Licensing Examination and Complaints (1)

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Original Contribution | Clinician's Corner
September 5, 2007
Physician Scores on a National Clinical Skills Examination
as Predictors of Complaints to Medical Regulatory
Authorities
Rajiv Tandon, PhD, Michael Abramowitz, PhD, Dale Daughlin, MD, et al.
Author Affiliations | Article Information
JAMA. 2007;298(9):993-1001. doi:10.1001/jama.298.9.993

1993 to 1996

Medical Licensing Examination

n = 3,424 physicians
Medical Council of Canada

→

Until 2005

Complaints Filed

1,116 complaints
Medical Regulatory Authority
(Ontario, Quebec)

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Licensing Examination and Complaints (2)

Written Examination: MCQ

Multiple-Choice Question Score

→

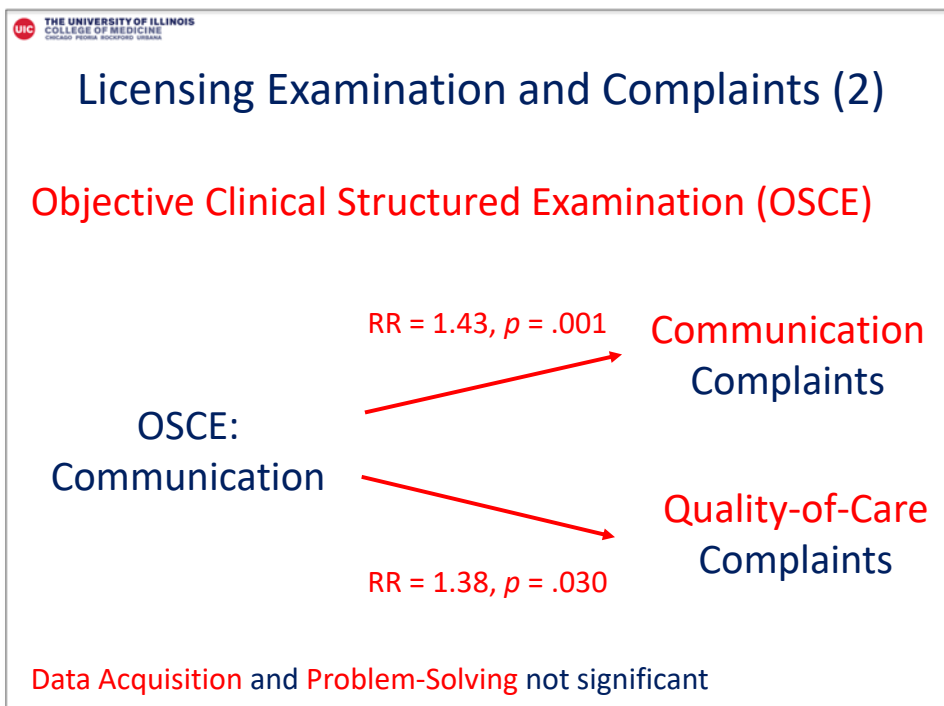
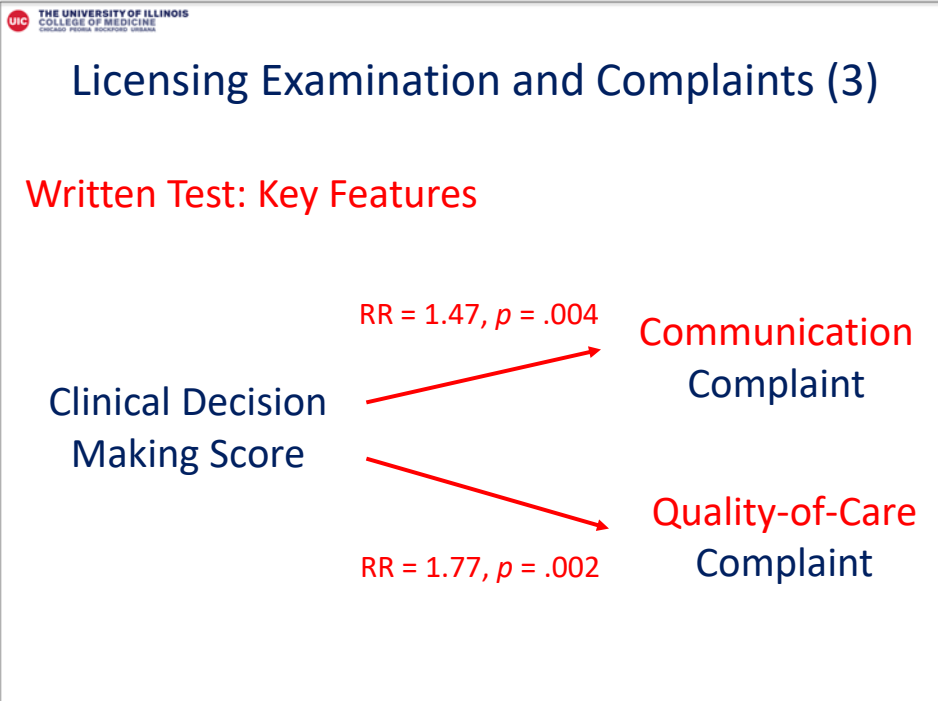
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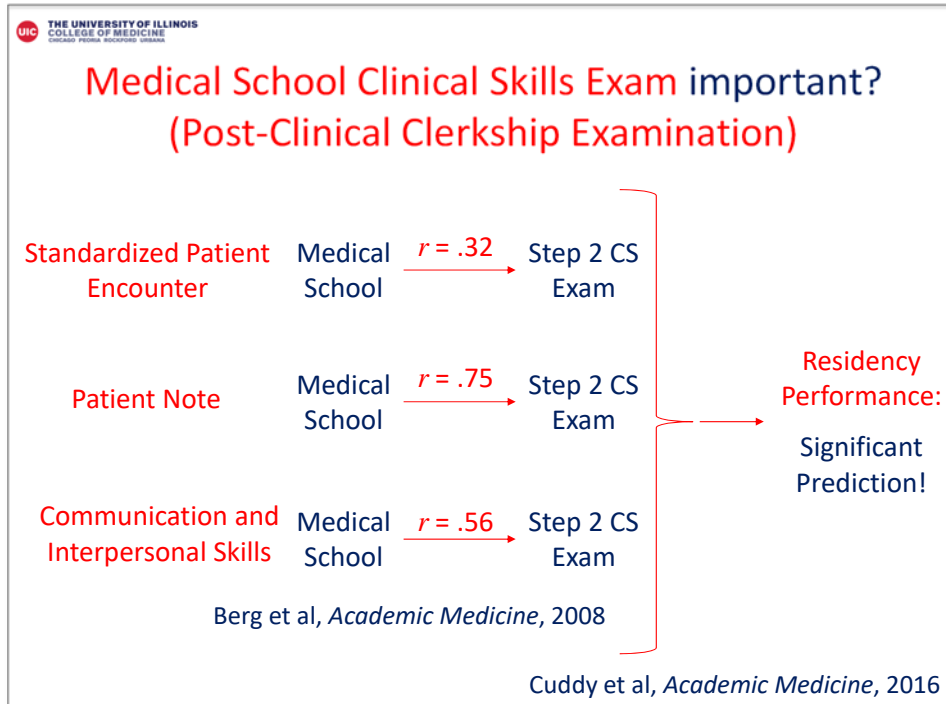
Communication Complaints

Quality-of-Care Complaints

Not Significant

Not Significant





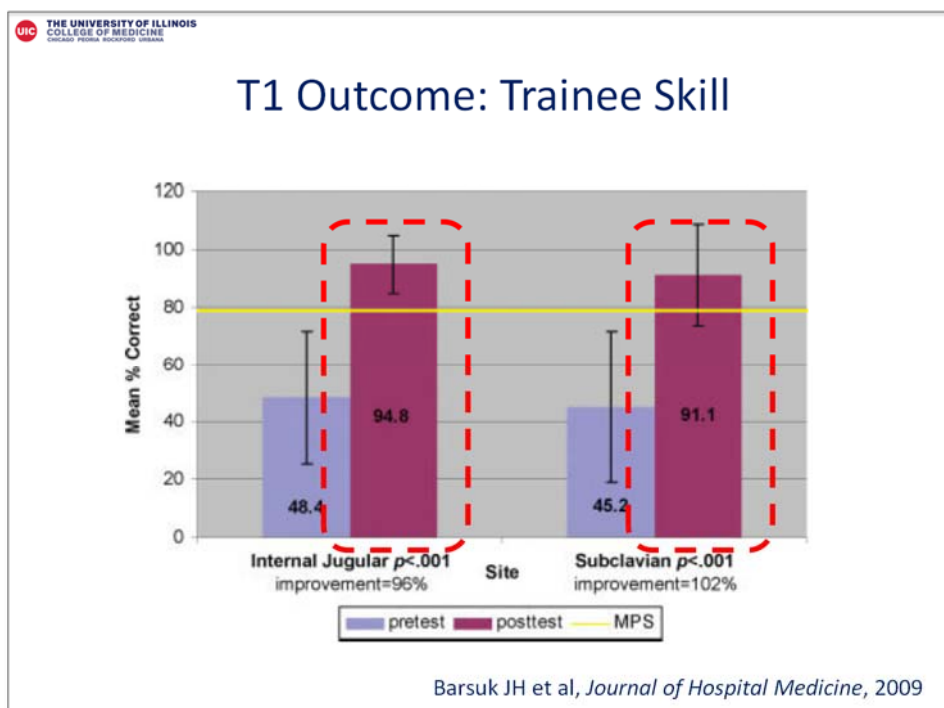
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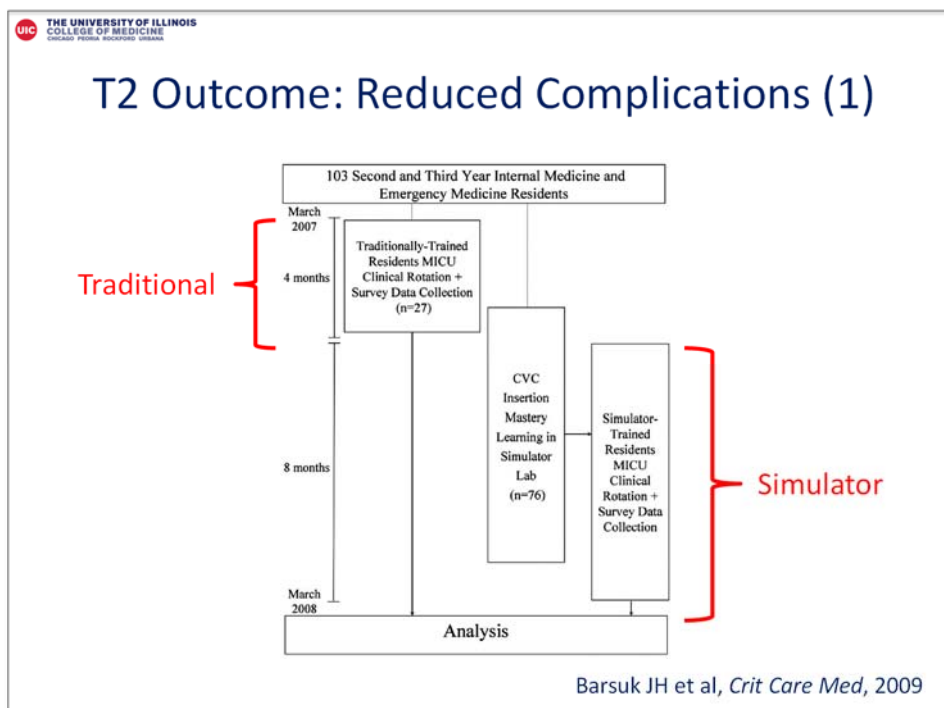
Translational Science: Central Venous Catheter (CVC) Insertion

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Central Venous Catheter (CVC) Insertion

- T1
 - CVC Insertion in Simulation Lab
 - CVC Insertion → Performance ↑
- T2
 - CVC Insertion → Complications in ICU ↓
- T3
 - CVC Insertion → Bloodstream Infection in ICU ↓
 - CVC Insertion → Cost Savings in ICU ↑

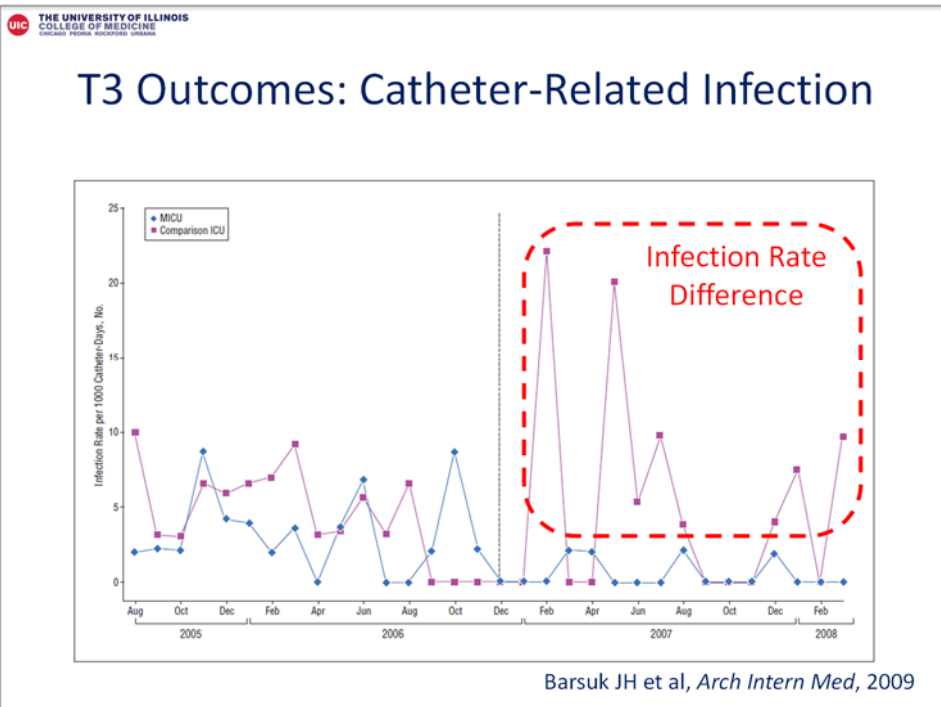
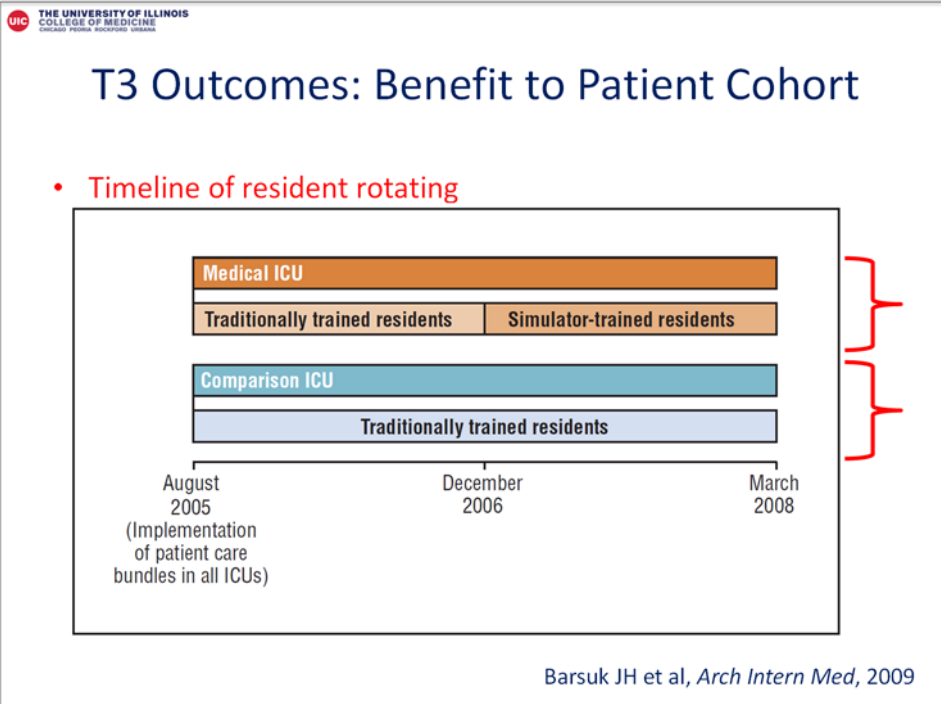




T2 Outcomes: Reduced Complications (2)

	Total CVCs, n = 164		p
	Traditionally Trained Residents	Simulator-Trained Residents	
# of CVCs	42	122	
Mean (SD) # of CVC needle passes	<u>1.74 (.83)</u>	<u>1.32 (.85)</u>	<.0005
Arterial puncture (%)	<u>6/42 (14%)</u>	<u>1/122 (1%)</u>	<.0005
CVC adjustment (%) ^a	<u>7/34 (21%)</u>	<u>5/116 (4%)</u>	.002
Success rate (%)	<u>34/42 (81%)</u>	<u>116/122 (95%)</u>	.005
Pneumothorax (%)	1/42 (2%)	2/122 (2%)	.76

Barsuk JH et al, *Crit Care Med*, 2009



T3 Outcomes: Reduced Hospital Costs

- **Annual Estimated Savings** (9.95 bloodstream infections)
 - \$820,000 savings
 - 137-141 patient hospital days
 - 120 MICU days
- **Cost of Intervention**
 - \$112,000
- **Net Savings**
 - \$707,000 (7:1 rate of return)

Cohen ER et al, *Simulation in Healthcare*, 2010

Team Training and Surgical Outcomes

The **JAMA** Network[®]

Original Contribution

October 20, 2010

Association Between Implementation of a Medical Team Training Program and Surgical Mortality

Julia Neely, RN, MS, MPH; Peter D. Mills, PhD, MS; Yinong Young-Xu, ScD, MA, MS; et al

> Author Affiliations | Article Information

JAMA. 2010;304(15):1693-1700. doi:10.1001/jama.2010.1506

- Briefing and debriefing in the Operating Room
- Training: 2 months (preparation), 1-day conference
- 182,409 procedures from 108 facilities
- **18% reduction in annual mortality**

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Adverse Events: Nurse-Physician Education

JAMA Internal Medicine

Original Investigation | Health Care Reform
April 11, 2011

Structured Interdisciplinary Rounds in a Medical Teaching Unit

Improving Patient Safety

Kevin J. O'Leary, MD, MS; Ryan Buck, MD; Helene M. Fligiel, MD, et al
 > Author Affiliations | Article Information
 Arch Intern Med. 2011;171(7):678-684. doi:10.1001/archinternmed.2011.1328

- Adverse Events

AEs, No. (No. per 100 patient-days)	Control Unit (n=185)	Intervention Unit Post-SIDR (n=185)	Incidence Rate Ratio (95% CI)	P Value
Any	63 (7.2)	35 (3.9)	0.54 (0.36-0.83)	.005
Preventable	25 (2.8)	8 (0.9)	0.27 (0.12-0.62)	.002
Serious	6 (0.7)	8 (0.9)	NA	NA
Serious and preventable	2 (0.2)	0 (0)	NA	NA

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Implications

Review Papers: T1 → T2 / T3

ANNALS OF SURGERY
A MONTHLY REVIEW OF SURGICAL SCIENCE SINCE 1885

Technical Skills Assessment Toolbox: A Review Using the Unitary Framework of Validity

Ghaderi, Iman MD¹; Manji, Farouq MD²; Park, Yoon Soo PhD²; Juul, Dorteia MD³; Ott, Michael MD⁴; Harris, Ilene PhD⁵; Farrell, Timothy M. MD⁶

Annals of Surgery, February 2015 - Volume 261 - Issue 2 - p 251-262
doi: 10.1097/SLA.0000000000000520
Reviews

2015
Review of T1 Assessments

ANNALS OF SURGERY
A MONTHLY REVIEW OF SURGICAL SCIENCE SINCE 1885

The Effect of Technical Performance on Patient Outcomes in Surgery: A Systematic Review

Fecso, Andras B. MD, Szasz, Peter MD, Kerezov, Georgi, Grantcharov, Teodor P. MD, PhD, FACS

Annals of Surgery, March 2017 - Volume 265 - Issue 3 - p 452-501
doi: 10.1097/SLA.0000000000001959
Review Paper

2017
Review of T2/T3 Assessments

Clinical Education Papers: T1 focused

Neurology[®] The most widely read and highly cited peer-reviewed neurology journal

April 26, 2016, 89 (17) ARTICLE

Validity and feasibility of the EMG direct observation tool (EMG-DOT)

Andrea N. Leap, Hunterford, Devon I. Rubin, Rupal S. Laughlin, Eric J. Sorenson, James C. Watson, Lynn K. Jones, Dorteia Juul and Yoon Soo Park
First published March 30, 2016. DOI: <https://doi.org/10.1212/WNL.0000000000002409>

Critical Care Medicine

Society of Critical Care Medicine

Validity and Feasibility Evidence of Objective Structured Clinical Examination to Assess Competencies of Pediatric Critical Care Trainees*

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Clinical Investigations

THE ANNALS OF THORACIC SURGERY
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Consensus-Derived Coronary Anastomotic Checklist Reveals Significant Variability Among Experts

Presented at the Poster Session of the Fifty-third Annual Meeting of The Society of Thoracic Surgeons, Houston, TX, Jan 21-25, 2017. Winner of the Blue Ribbon as the top Cardiothoracic Education Poster.

Ara A. Vaportzian MD, MHP^{1,2,3}; Vafaie, MD, Matthew C. Lineberry, PhD, Yoon Soo Park, PhD, Ara Taheri, PhD, MHP⁴

Ophthalmology AMERICAN ACADEMY OF OPHTHALMOLOGY[®]

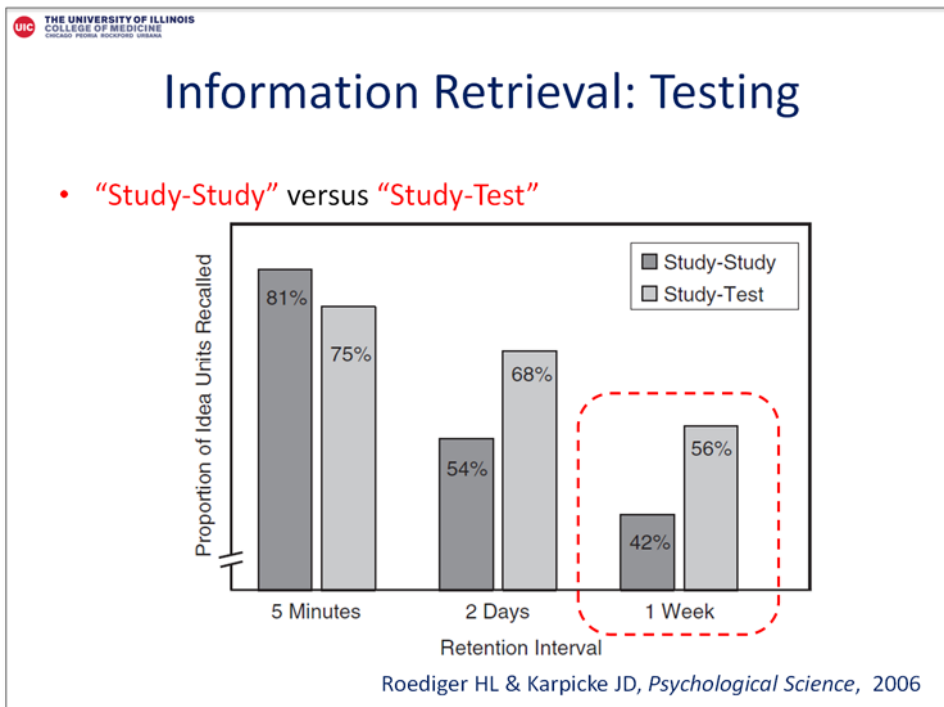
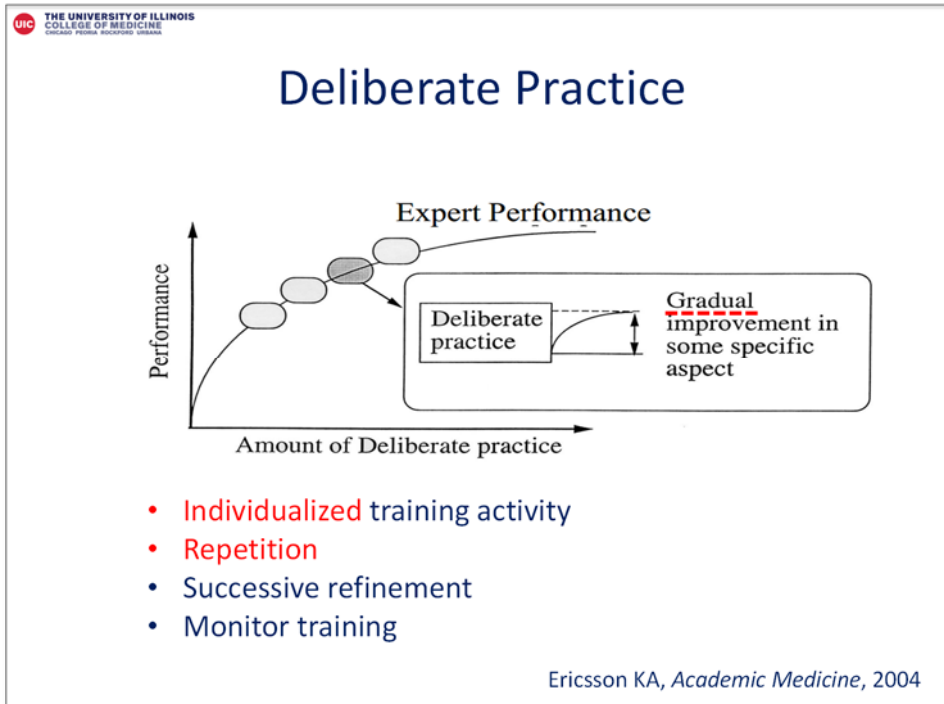
Operating Room Performance Improves after Proficiency-Based Virtual Reality Cataract Surgery Training

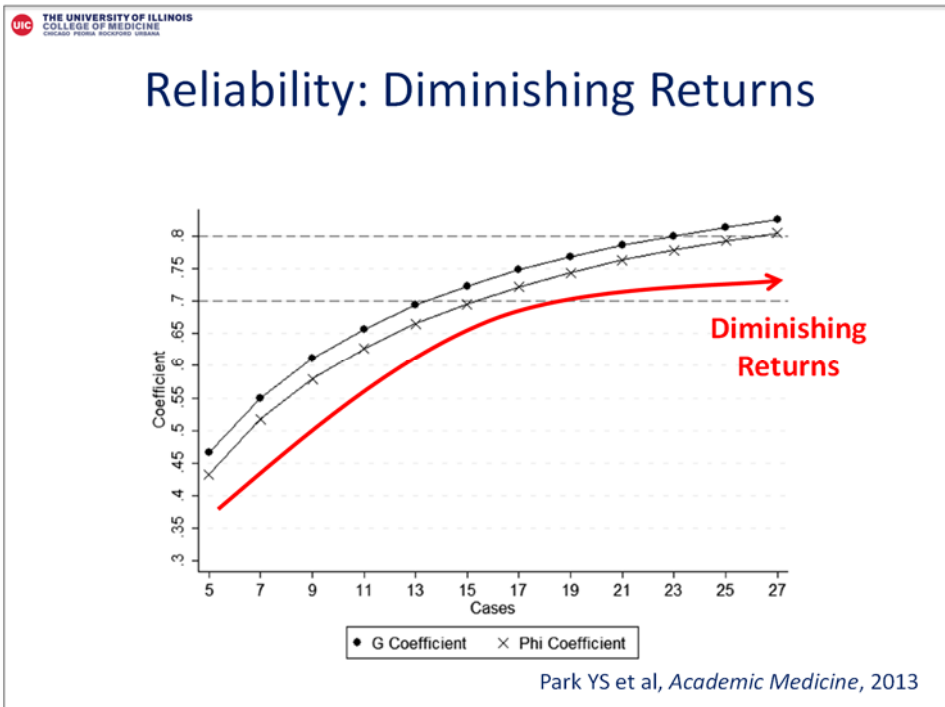
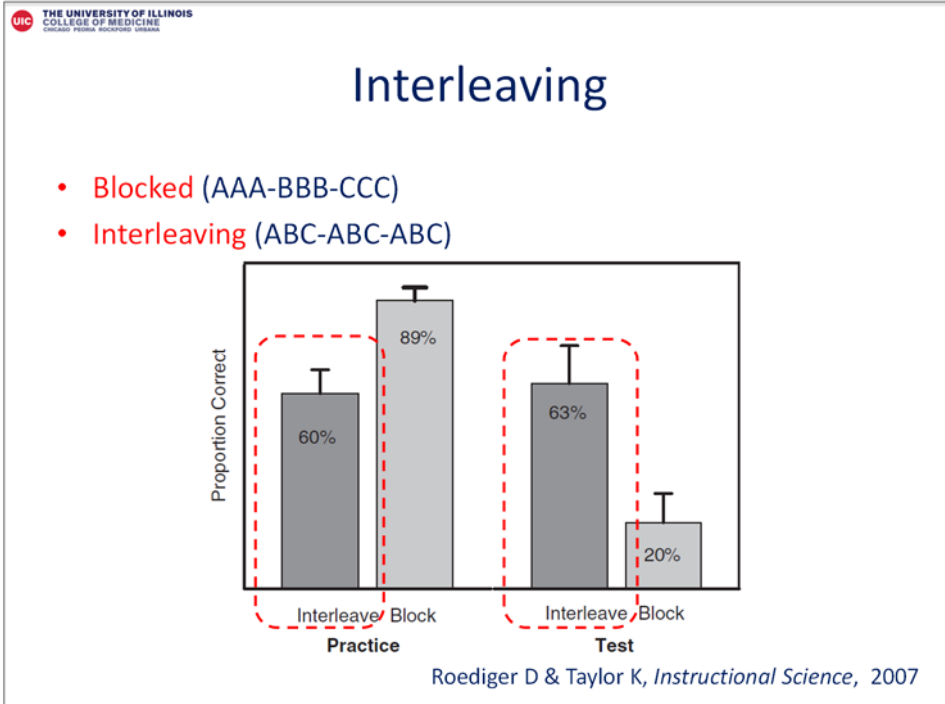
Ann Sofia Skou-Thomsen, MCE^{1,2,3}; Daniela Bach-Holm, PhD, MD, Hadi Kiartha, MD, Klaus Hejgaard-Olsen, MD, Yousef Sobhy, MD, George M. Saleh, FRCSEd, FRCOphth, Yoon Soo Park, PhD, Morten la Cour, DMSc, MD, Lars Krøgh, PhD, MD

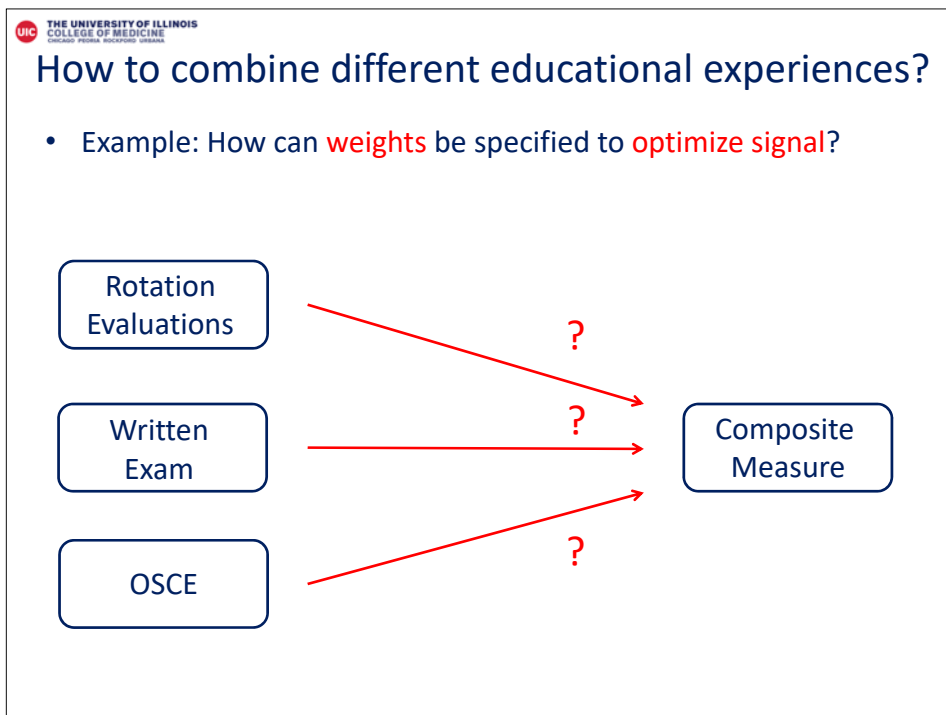
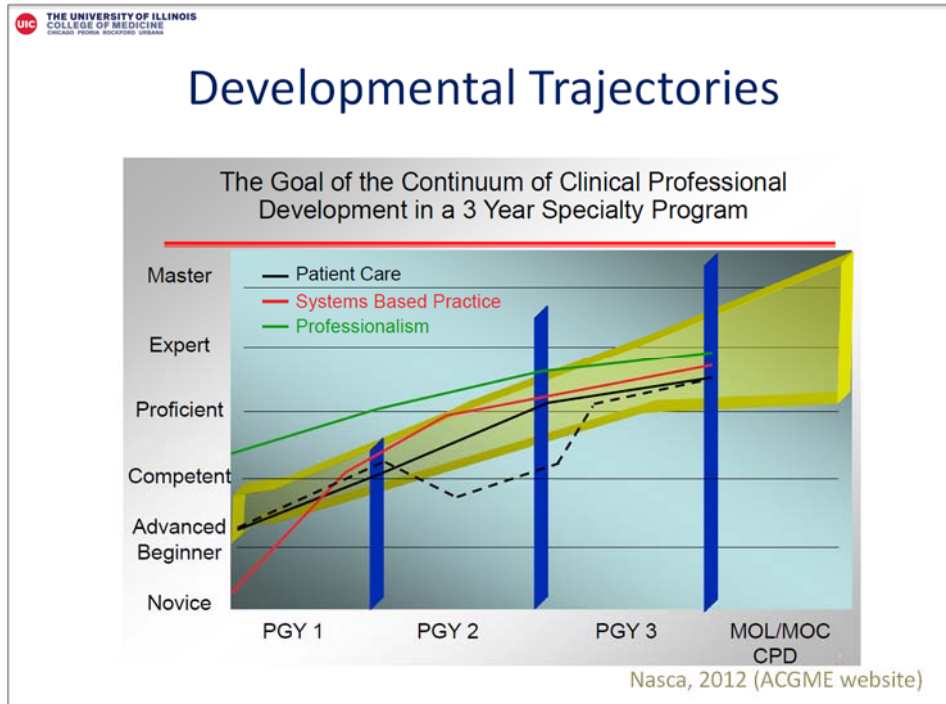
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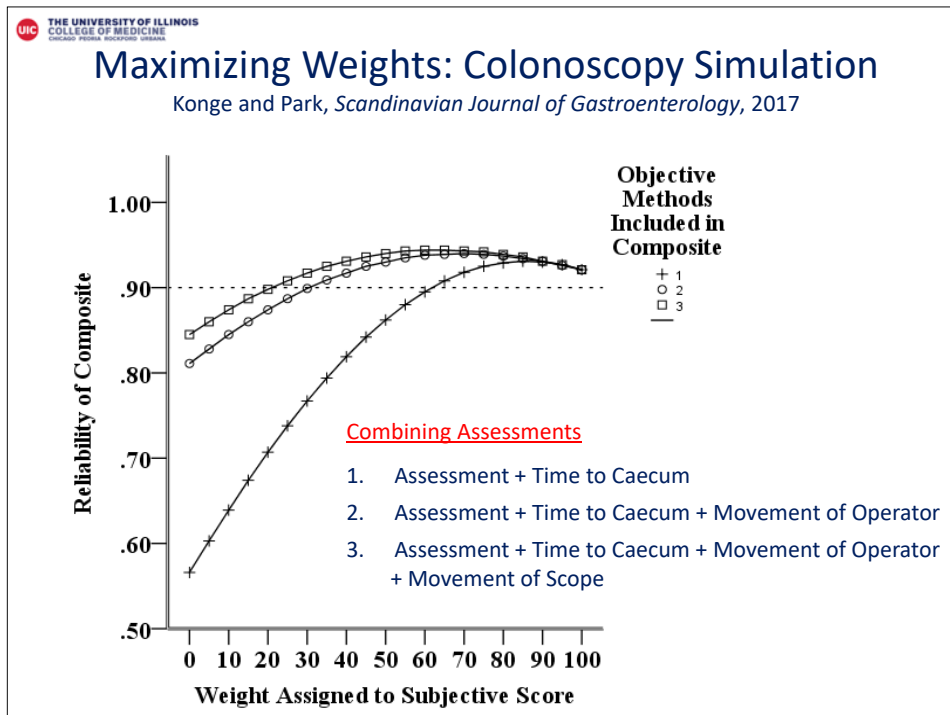
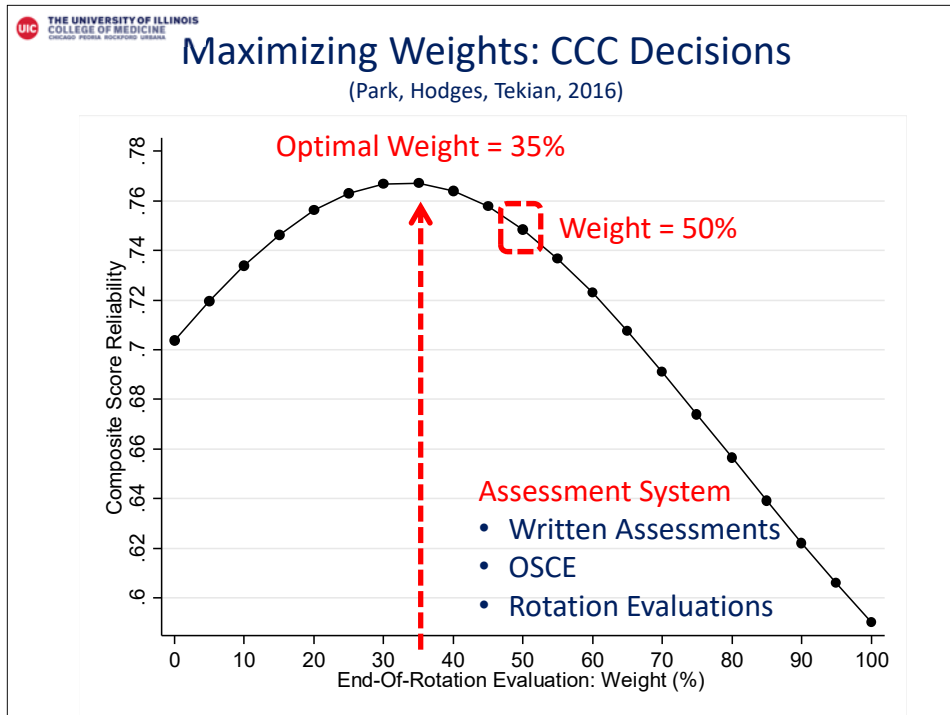
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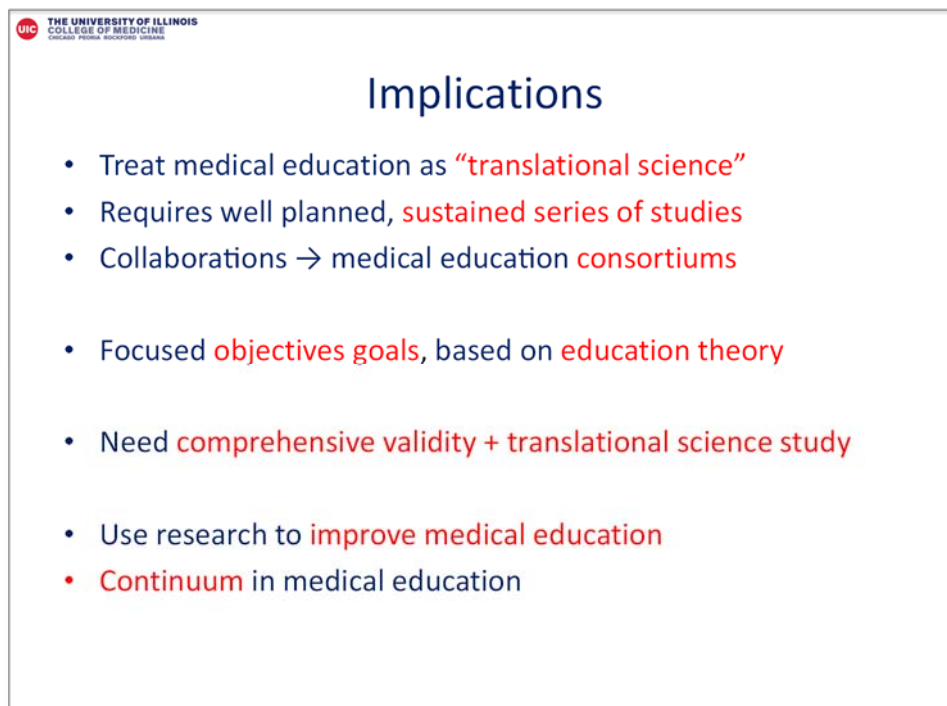
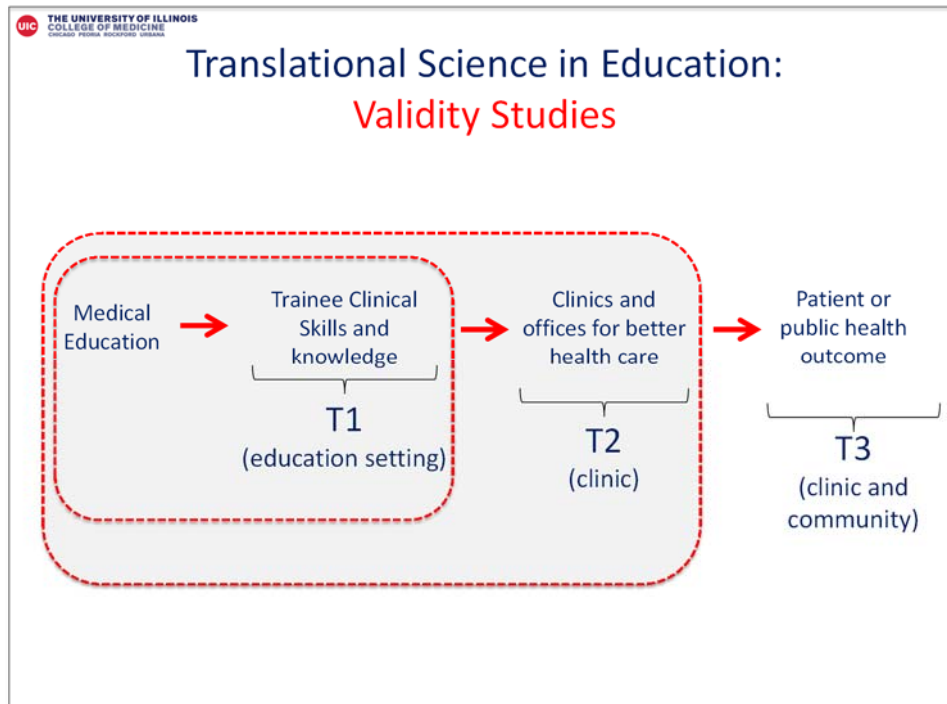
    graph LR
      A[Medical Education] --> B[Trainee Clinical Skills and knowledge]
      B --> C[Clinics and offices for better health care]
      C --> D[Patient or public health outcome]
      subgraph T1 [T1 (education setting)]
        A
        B
      end
      subgraph T2 [T2 (clinic)]
        C
      end
      subgraph T3 [T3 (clinic and community)]
        D
      end
      B --- T1
      C --- T2
      D --- T3
      T1 --- T2
      T2 --- T3
    
```













Questions

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