

A Mastery Model for Teaching Clinical Skills

Workshop SGIM 2010

Minneapolis, Minnesota

Presenters:

John Butter

Vinky Chadha

Aashish Didwania

Diane Wayne

All from Northwestern University Feinberg School of Medicine,
Chicago, IL

Contact: JButter@nmff.org



NORTHWESTERN
UNIVERSITY



NORTHWESTERN
UNIVERSITY

- Define a mastery model of education
- Demonstrate a cardiac auscultation curriculum as a model of mastery learning for a clinical skill
- Review standard setting techniques
- Participate in a standard setting exercise: Angoff and Hofstee methods
- Discuss how you can do this at your institution

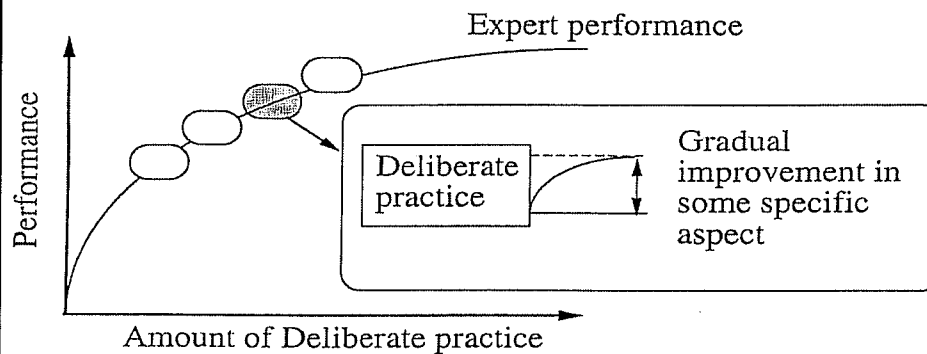


NORTHWESTERN
UNIVERSITY

- A form of competency-based education in which all learners achieve a predetermined level of proficiency (mastery) of a skill
- The desired outcome does not vary but the time to achieve mastery may vary.
- Focuses on outcome, not process
- Congruent with ACGME competency requirements



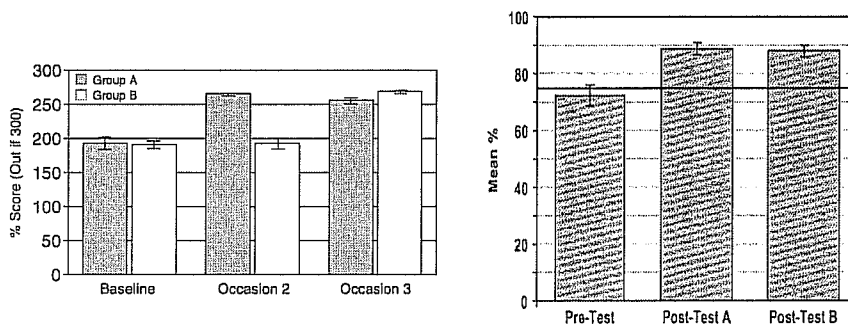
NORTHWESTERN
UNIVERSITY



A. Ericsson 2007



NORTHWESTERN
UNIVERSITY



Wayne *Teach Learn Med* 2005
Wayne *JGIM* 2006



NORTHWESTERN
UNIVERSITY

- Cardiac auscultation skills are deficient
- More effective methods of teaching cardiac auscultation skills are needed
- Impact of training on actual patients could be studied

Mangione *Ann Intern Med*, 1993
Mangione *JAMA*, 1997



NORTHWESTERN UNIVERSITY

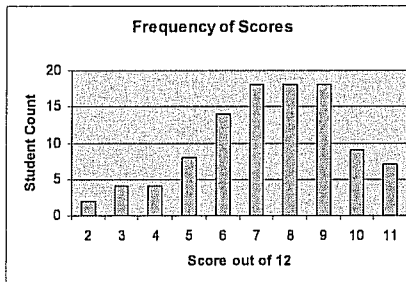
- Assess baseline level of proficiency
- Design curriculum
- Use an expert panel to determine a minimum passing score
- Implement curriculum



NORTHWESTERN UNIVERSITY

N=100 M3s from 3 Chicago institutions

Big 12 Finding	M3 % Correct
Innocent murmur	42%
Aortic stenosis	65%
Aortic regurgitation	36%
Mitral regurgitation	65%
Mitral stenosis	25%
Continuous murmur	94%
Tricuspid regurgitation	70%
S4	61%
Systolic click	47%
S3	62%
Pericardial rub	91%
Split S2	92%
Overall % Correct	62.4%



Mean=7.49

Students were assessed using an online examination that was multiple choice and case based



NORTHWESTERN
UNIVERSITY

- **Select Judges**
- **Train Judges**
- **Select standard setting techniques**
 - Angoff and Hofstee
- **Set standards for MPS**
- **Regroup in 6-8 weeks to review stability of judgments**
- **Insert standards into curriculum**

Norcini and Guille, 2002
Kane MT, 1994



NORTHWESTERN
UNIVERSITY

- Angoff – item based
- Hofstee – group based



NORTHWESTERN UNIVERSITY

- Define a group of borderline residents who have a 50% chance of passing
- Each judge estimates the proportion of borderline examinees who would correctly perform each step

Central Line Placement (LJ)

Skill Key: A = Done Correctly B = Done Incorrectly C = Not Done

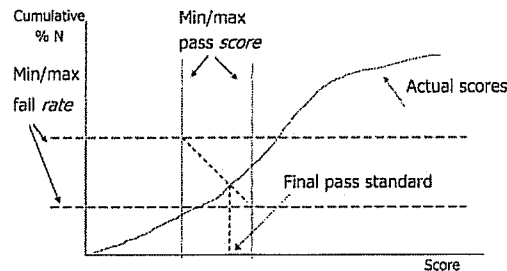
Informed consent obtained Benefits (medicines, fluids etc) 1 Risks Infection Bleeding 2 Consent given 1	A	B	C
Place the patient in slight Trendelenburg position	A	B	C
Test each port and flush the lines with sterile saline.	A	B	C
Clamp each port (ok to keep brown port off)	A	B	C
Remove brown port from end of line to accommodate wire.	A	B	C
Must be done 3 x Area is cleaned with chlorhexadine	A	B	C

Downing et al Teach Learn Med 2006
Norcini Med Educ 2003



NORTHWESTERN UNIVERSITY

- Each panelist records judgments about:
 - Minimum acceptable required passing score
 - Maximum acceptable required passing score
 - Minimum acceptable failure rate
 - Maximum acceptable failure rate

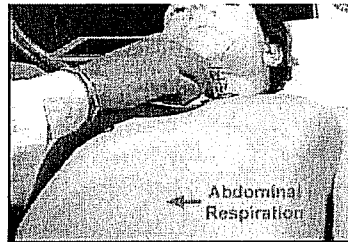


Downing et al Teach Learn Med. 2006



NORTHWESTERN
UNIVERSITY

- 18 year-old woman
- Referred for murmur
- Asymptomatic
- HR=60 BP=110/80
- Listen USLE- diaphragm



NORTHWESTERN
UNIVERSITY

- Panel of 16 experts
- Consisted of clerkship directors, cardiologists, and an educational deans from three medical schools
- Average of Angoff and Hofstee methods was 75%
- Repeat standard setting at 6-8 weeks

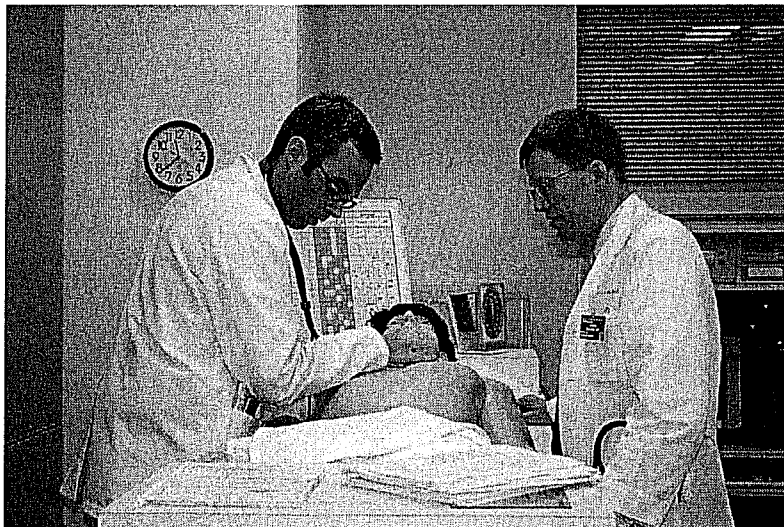


NORTHWESTERN
UNIVERSITY

- Self study with interactive cardiac auscultation tutorial developed by the University of Miami
- Deliberate practice
- Unlimited time with tutorial
- Directed teaching with Harvey, the high fidelity cardiac simulator, for 30-45 minutes, led by an experienced clinical educator
- Posttest with computer and actual patients



NORTHWESTERN
UNIVERSITY





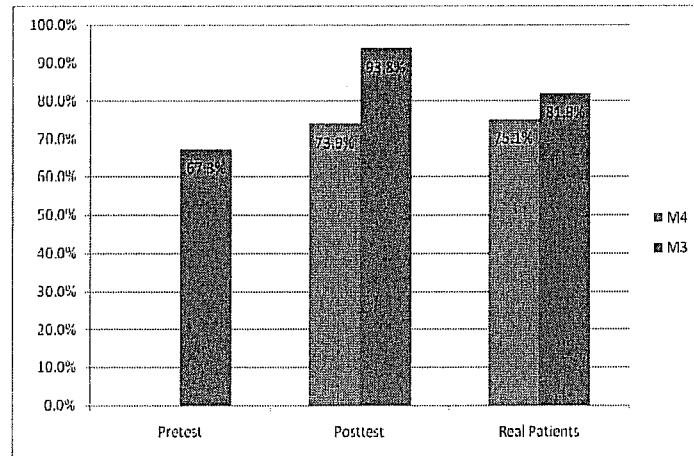
NORTHWESTERN
UNIVERSITY

- 4-5 patients were examined by at least two experienced cardiologists
- Credit given to the learners for any result selected by the cardiologists



NORTHWESTERN
UNIVERSITY

- 4 M3 students (5.2%) didn't achieve the MPS and required additional practice. All achieved mastery with less than one hour of additional practice.
- 13 M4 students (58.1%) didn't achieve the MPS score



- It is feasible to implement a mastery model of clinical skills acquisition which ensures that all learners achieve competency.
- Determining the threshold for proficiency requires time and work but can be done
- In the example presented, the cardiac auscultation curriculum resulted in improved skills as assessed with simulated heart sounds and actual patients



NORTHWESTERN
UNIVERSITY

- We extend our appreciation to Dr. Barry Issenberg and his colleagues at the University of Miami for making the cardiac auscultation tutorial and assessment tools available.
- We also thank all of the students, residents and faculty who participated in our project and the Augusta Webster Office of Medical Education and Department of Medicine for supporting us.
- Funding source: Augusta Webster Office of Medical Education



NORTHWESTERN
UNIVERSITY

- University of Miami developed the cardiac auscultation tutorial
- More information is available on their website.
- www.gcrme.med.miami.edu

Baseline Data on 12 Cardiac Auscultation Patient Scenarios

M3 (n=100)

Pretest mean score: 7.49 (2.07)

Big 12 Finding	M3 % Correct
Innocent murmur	42%
Aortic stenosis	65%
Aortic regurgitation	36%
Mitral regurgitation	65%
Mitral stenosis	25%
Continuous murmur	94%
Tricuspid regurgitation	70%
S4	61%
Systolic click	47%
S3	62%
Pericardial rub	91%
Split S2	92%

MASTERY	Pretest score	Posttest score	p-value
NU M3s N=46	7.91 (1.87)	10.17 (1.91)	.000
NU M4s N=6	9.00 (2.26)	10.83 (1.84)	.058
IM Residents N=10	9.50 (1.51)	11.90 (0.32)	.001
All subjects N=62	8.27 (1.97)	10.52 (1.84)	.000

M3 Performance n=100

Raw Score	% Correct	Frequency
2	17	2
3	25	4
4	33	4
5	42	8
6	50	14
7	58	18
8	67	18
9	75	18
10	83	9
11	92	7
Mean= 7.49	Mean=62.4%	
-1 SD= 5.42	-1 SD= 42%	
-2 SD= 3.35	-2 SD= 28%	

Cardiac Auscultation Skills Standard Setting

Angoff Method

1. Select the judges.
2. Discuss the purpose of the test, the nature of the examinees, and what constitutes adequate and inadequate skills/knowledge.
3. Define the “borderline” group, a group that has a 50 - 50 chance of passing.
4. Read the first item.
5. Each judge estimates the proportion of the borderline group that would get it correct.
6. The ratings are recorded for all to see, discuss, and change as appropriate.
7. Repeat steps 4 to 6 for each item.
8. Calculate the passing score by averaging the estimates of all judges for each item and summing the items.

Norcini JJ. Setting standards on educational tests. *Med Educ.* 2003 May;37(5):464-9.

Angoff Worksheet

M3 Cardiac Auscultation Skills

Big 12 Finding	% of borderline M3s with correct responses
Innocent murmur	
Aortic stenosis	
Aortic regurgitation	
Mitral regurgitation	
Mitral stenosis	
Continuous murmur	
Tricuspid regurgitation	
S4	
Systolic click	
S3	
Pericardial rub	
Split S2	

Angoff Judgments- Group Worksheet

	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Average
Innocent murmur						
Mitral stenosis						
Split S2						

Cardiac Auscultation Skills Standard Setting

Hofstee Method

1. Select the judges.
2. Discuss the purpose of the test, the nature of the examinees, and what constitutes adequate and inadequate skills/knowledge.
3. Review the test in detail.
4. Ask the judges to answer four questions:
 - a. What is the minimum acceptable required passing score?
 - b. What is the maximum acceptable required passing score?
 - c. What is the minimum acceptable fail rate?
 - d. What is the maximum acceptable fail rate?
5. After the test is given, graph the distribution of scores and select the cut score as described by De Gruiter.*

Cardiac Auscultation Skills Standard Setting Hofstee Method
--

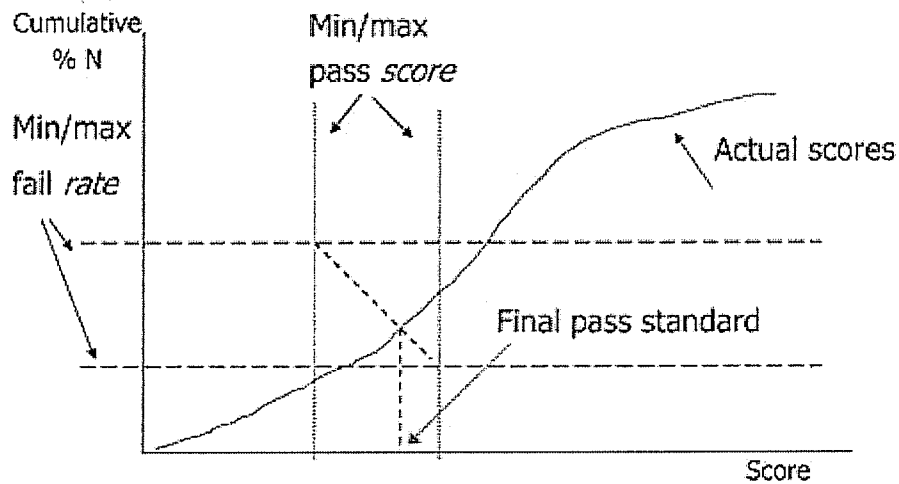
Cardiac Auscultation M3s	Minimum acceptable required passing score	Maximum acceptable required passing score	Minimum acceptable fail rate	Maximum acceptable fail rate

* De Gruitjer DNM. Compromise models for establishing examination standards. *Journal of Educational Measurement* 1985; 22(4): 263-269.

Hofstee Judgments- Group Worksheet

	Judge 1	Judge 2	Judge 3	Judge 4	Judge 5	Average
Minimum required passing score						
Maximum required passing score						
Minimum acceptable fail rate						
Maximum acceptable fail rate						

Hofstee example using rater means to obtain pass score by graphing onto cumulative percent data.¹



Downing SM, Tekian A, Yudkowsky R. Procedures for Establishing Defensible Absolute Passing Scores on Performance Examinations in Health Professions Education. *Teaching and Learning in Medicine*. 2006; 18(1), 50-57.