HARVARD MEDICAL SCHOOL
TEACHING HOSPITAL

Interventional Cardiology Fellow Didactics: Teaching Procedures and Decision-Making in a Flipped Classroom

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CARDIOVASCULAR RESEARCH CENTER

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Competency-Based Medical Education

- Competency-based medical education:
- proficiency in knowledge and technical ability valued over time on rotation
- ACGME: “Patient Care and Procedural Competencies” for Interventional Cardiology Fellowship training
- combination of proficiency and time spent on various rotations

Competency-Based Procedural Training: Where Do We Begin?

Procedural Realm (ie, Cath Lab)

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Classroom

Technical Aspects:

- Stent selection
- Guide-support
- Wiring a lesion
- Lesion modification
- Equipment delivery
- Mechanical support
- Etc.

Decision-Making:

- Preparing for battle…
- Belt and suspenders approaches
- When to stop….

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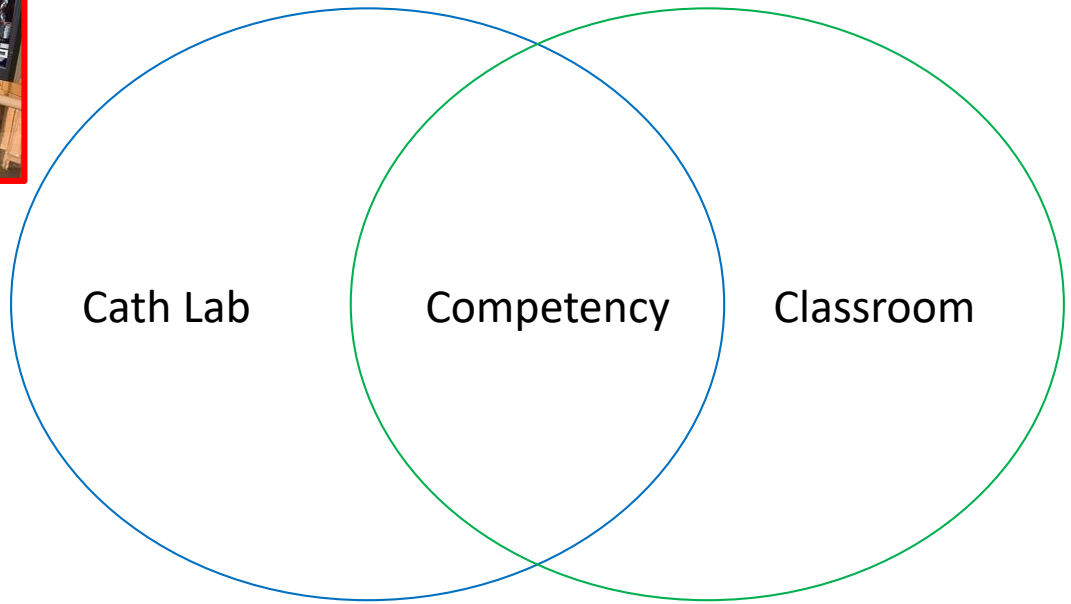
Competency-Based Procedural Training: Where Do We Begin?



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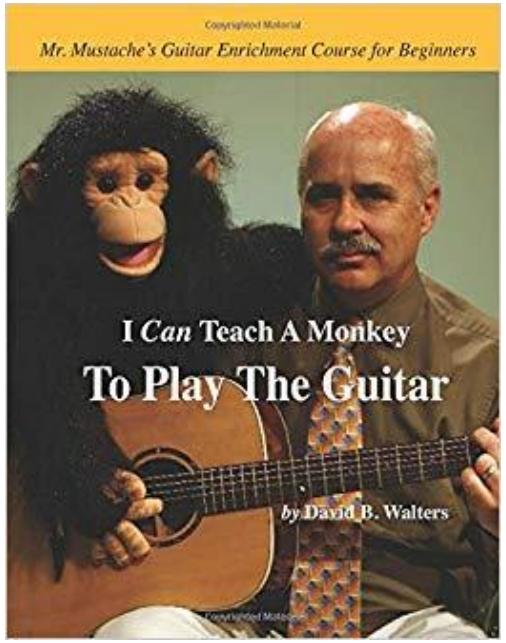
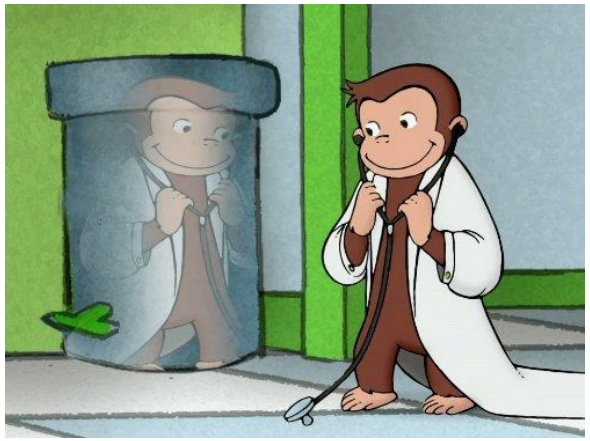
Competency-Based Procedural Training: What is Competency?





"You can teach a monkey to do cath….but you can't teach him good judgement…"
(un-named esteemed cardiology mentor)

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Achieving and Maintaining Competency: Relative Importance of Technical Skills and Decision-Making

Early in Training

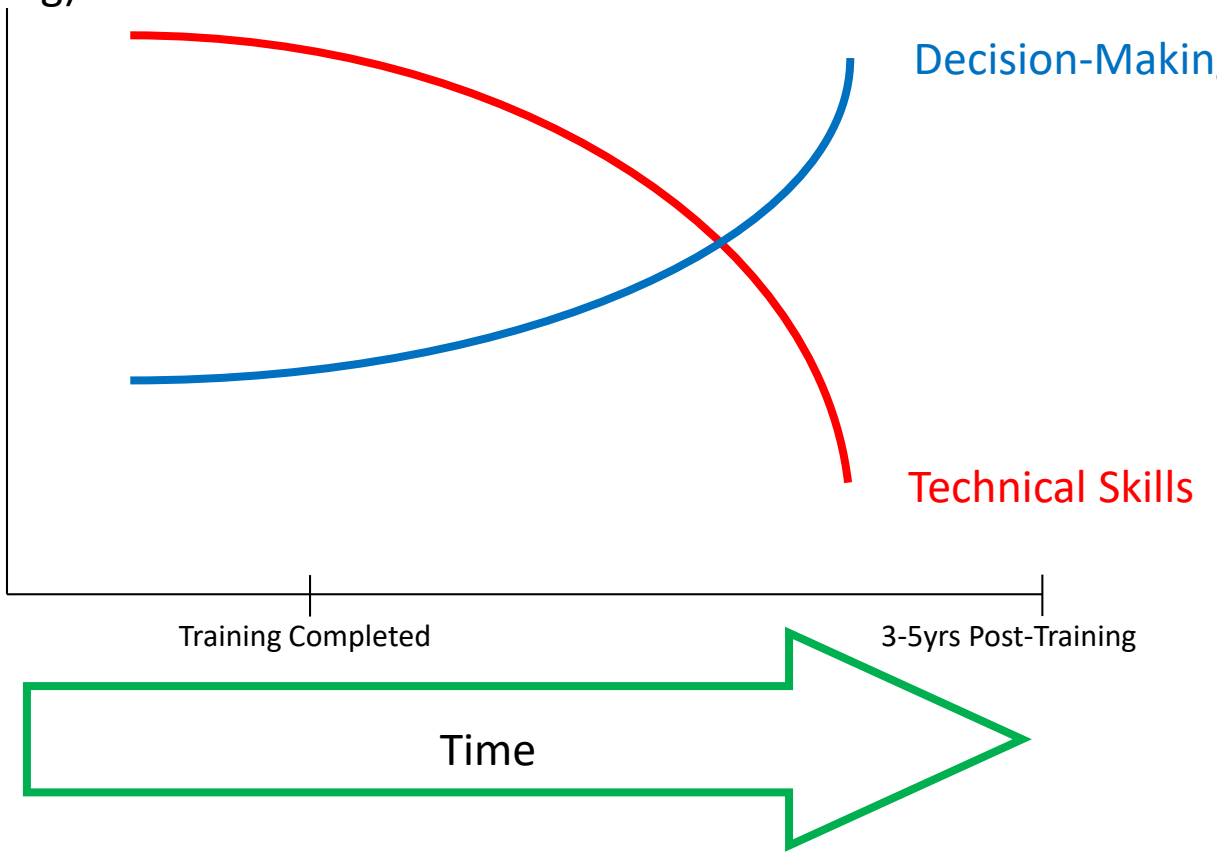
Decision-Making: We are going to stent the LM ad hoc….(attending)

Technical skills: guide, wire, balloon, stent….(fellow then attending)

Early in Career

Decision-Making: Continually evolving

Technical skills: largely developed/mature as independent-operator



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Competency-Based Procedural Training: Where Do We Begin?

- Flipped Classroom
- study lecture conte
- didactic sessions: gained knowledge
- Requirements:
- Curriculum
- Didactic sessions
- ….participation!

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PNAS PNAS PNAS

Active learning increases student performance in science, engineering, and mathematics

Scott Freeman[a,1], Sarah L. Eddy[a], Miles McDonough[a], Michelle K. Smith[b], Nnadozie Okoroafor[a], Hannah Jordt[a], and Mary Pat Wenderoth[a]

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Edited* by Bruce Alberts, University of California, San Francisco, CA, and approved April 15, 2014 (received for review October 8, 2013)

To test the hypothesis that lecturing maximizes learning and course performance, we metaanalyzed 225 studies that reported data on examination scores or failure rates when comparing student performance in undergraduate science, technology, engineering, and mathematics (STEM) courses under traditional lecturing versus active learning. The effect sizes indicate that on average, student performance on examinations and concept inventories increased by 0.47 SDs under active learning (n = 158 studies), and that the odds ratio for failing was 1.95 under traditional lecturing (n = 67 studies). These results indicate that average examination scores improved by about 6% in active learning sections, and that students in classes with traditional lecturing were 1.5 times more likely to fail than were students in classes with active learning. Heterogeneity analyses indicated that both results hold across the STEM disciplines, that active learning increases scores on concept inventories more than on course examinations, and that active learning appears effective across all class sizes—although the greatest effects are in small ($n \leq 50$) classes. Trim and fill analyses and fail-safe n calculations suggest that the results are not due to publication bias. The results also appear robust to variation in the methodological rigor of the included studies, based on the quality of controls over student quality and instructor identity. This is the largest and most comprehensive metaanalysis of undergraduate STEM education published to date. The results raise questions about the continued use of traditional lecturing as a control in research studies, and support active learning as the preferred, empirically validated teaching practice in regular classrooms.

constructivism | undergraduate education | evidence-based teaching | scientific teaching

225 studies in the published and unpublished literature. The active learning interventions varied widely in intensity and implementation, and included approaches as diverse as occasional group problem-solving, worksheets or tutorials completed during class, use of personal response systems with or without peer instruction, and studio or workshop course designs. We followed guidelines for best practice in quantitative reviews (*SI Materials and Methods*), and evaluated student performance using two outcome variables: (*i*) scores on identical or formally equivalent examinations, concept inventories, or other assessments; or (*ii*) failure rates, usually measured as the percentage of students receiving a D or F grade or withdrawing from the course in question (DFW rate).

The analysis, then, focused on two related questions. Does active learning boost examination scores? Does it lower failure rates?

Results

The overall mean effect size for performance on identical or equivalent examinations, concept inventories, and other assessments was a weighted standardized mean difference of 0.47 (Z = 9.781, $P << 0.001$)—meaning that on average, student performance increased by just under half a SD with active learning compared with lecturing. The overall mean effect size for failure rate was an odds ratio of 1.95 (Z = 10.4, $P << 0.001$). This odds ratio is equivalent to a risk ratio of 1.5, meaning that on average, students in traditional lecture courses are 1.5 times more likely to fail than students in courses with active learning. Average failure rates were 21.8% under active learning but 33.8% under traditional lecturing—a difference that represents a 55% increase (Fig. 1 and Fig. S1).

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Interventional Cardiology Training/Education: Flipped Classroom Approach at MGH

- **Example**: watch a course on bifurcation stenting independently, then review bifurcation cases as a group
- **Curriculum**: SCAI Fellow Course
- **Didactic sessions**: bimonthly morning conference for case reviews relevant to course lecture– topic selected by attending (early in the year) or fellows (later in year)
- **Response/Early Experience**:

- fellows actively participating
- usual challenges of morning consent, follow-up,…cath lab staff supportive
- working on engaging attendings to provide updated teaching materials

SCAI Fellow Course Curriculum

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Collaborative Opportunities: ACC and SCAI Joint Curriculum

- Identify Core Competencies in Interventional Fellow Education
- Balance Technical and Decision-Making Elements of Competency
- Distill Evidence for Major Interventional Topics
- Incorporate Expert Opinion in “Data-free zones”

Thank You!

- ACC – Mike Valentine, MD and Julie Damp, MD
- Doug Drachman, MD
- Lisa DeFabritiis, Cardiology Education Program Manager at MGH
- MGH Interventional Fellows
- MGH Cath Lab Staff