Educational Delivery of Surgical Skills

Sandra Pinkerton, PhD
Marilyn A. Peterson, MA

Texas Health Research Institute
Literature Review
Epstein RM, Hundert EM

- Defining and assessing professional competence
  - JAMA. 2002;287(2):226-235
  - Editorial Comment p 243.
  - Focus: Generated an inclusive definition of professional competence and recommended new formats for its assessment.
Epstein, et al.

Definition of professional competence

- The habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served.
Epstein, et al

- Surgical/procedural skills
  - One line item in a list of many relevant & important items.
  - Little or no discussion about evaluation

- Implications
  - While surgical/procedural skills on the radar screen, not a burning priority overall.
Gawande, A

The learning curve


Focus: Learning surgical procedures

- Explores the learning curve (LC) for new surgical techniques
- Discusses the patient-surgeon relationship along that LC
…many studies of élite performers – concert violinists, professional ice skaters, etc – the biggest difference between them and lesser performers is their amount of deliberate practice.

Most important talent – a person’s willingness to engage in sustained training.
Surgical training process

- Floundering, followed by knowing fragments of what to do, followed by knowledge, and, occasionally, a moment of elegance
- Over and over again, for ever harder tasks with greater risks
Gawande, A

- Edmonson AC, Bohmer R, & Pisano, G.
  - Learning new technical & interpersonal routines in operating room teams: The case of minimally invasive cardiac surgery.
  - In Research on Managing Groups and Teams: Technology, edited by Neale MM & Grifith T.
Edmonson, et al. studied LC in surgery

- Investigated 18 cardiac surgeons & their teams learning a new technique in cardiac surgery
- All experienced teams from highly respected institutions. Same 3-day training course.
- New technique performance took 3 times longer in early cases
- In 1st 50 cases, some teams halved their performance time. Other didn’t improve.
Edmonson, et al. Conclusions

Teamwork & communications played significant roles in lowering LC

Implications

More deliberate CMEST training and progress tracking

Fact: Even at best, surgeons get worse before getting better when learning a new technique.
Gawande, A

- Implications cont.
  - LC longer than expected.
  - LC affected by more complicated range of factors than realized.
Improving CME for surgical techniques: Applying the lessons learned in the first decade of minimal access surgery


Focus:
Improving CME for surgical techniques (CMEST)
Rogers, et al.

- Motivated by concerns of training adequacy arising after introduction of laparoscopic cholecystectomy.
- Discovered no systematic review of CME for technical skills in literature.
Concerns of adequacy of short courses for CMEST for cholecystectomy included:

- Steep learning curves
- Common bile duct injuries
- Massive hemorrhage
- Death

Rogers, et al.

  - 1991 Gadacz & Talamini Am J Surg
  - 1992 Zucker Surg Laparosc Endosc
  - 1997 Gates Am J Obstet Gynecol
  - 1999 Reznick Foc Surg Ed
Rogers, et al.

- Survey of practicing surgeons concurred that weekend courses did not adequately prepare them to perform procedure.

- 2nd survey showed higher complication rates in the initial experience in surgeons performing procedures after weekend courses.
  See, et al. 1993 JAMA
Rogers, et al.

- SAGES Guidelines for CMEST courses & for granting privileges for MAS procedures. (Developed early in MAS)
- In addition to a course, surgeon to have experience as assistant & then perform initial procedure under supervision of surgeon with MAS privileges.
Rogers, et al.

- Survey showed that only $\frac{1}{2}$ of the surgeons actually followed all the SAGES guidelines.
  Escare, et al. 1997 Med Care

- Reasons:
  - Lack of training opportunities
  - Training cost
  - Lack of experienced colleagues
Most research on CME has evaluated courses designed to impart new knowledge or nontechnical skills.

CME community beginning to recognize that psychomotor skill acquisition is different from other types of learning.

Lewis, 1998 West J Med
Rogers, et al.

“Practice improves performance”
- Learning surgical skills shares features with general motor skills learning.”
  - Ericsson 1994 Am Psychol
- Seems to apply equally to residents and experienced surgeons.
  - Rosser 1998 Arch Surg
“Practice improves performance” cont

Approach: teaching a complex surgical skill by dividing it into simpler component tasks - validated.

- Lane 1987 Springer-Verlag
Rogers, et al.

- Gap in literature:
  - No proof of relationship between performance in simulated environments (traditional or computer) and actual surgery.
  - 1st step: inanimate model to animal model.
Rogers, et al.

- Learning Curves (LC)
  - Graphic representations of experience with a procedure and some outcome variable, e.g. operative time.
  - With increasing experience –
    - Decreased operative time
    - Lower complication rates
    - Fewer conversions to open procedure
Rogers, et al.

- Surgical LC similar to motor skills performance curve
  - Improvement occurs early (steep LC)
  - With experience less improvement (flatter LC)

- Implications for CMEST
  - Additional evidence that motor performance strategies applicable to surgical training.
  - Small increase in practice early on could substantially improve technical performance.
Rogers, et al.

- Curves for declining operative time and complication rates similar to LC.
  - Increased task familiarity increases confidence, increasing speed and lowering errors.

- Implications for CMEST
  - Increase & measure procedure speed & accuracy.
Rogers, et al.

- Shape of LC varies with individual & task
  - Not same predictable curve as that of group
  - Same for surgery & motor skills learning
- Implications for CMEST
  - Build individual variability into CME courses.
Three-Stage Motor Skills Model

- Fitts & Posner, 1978; Noted in surgical literature

1\textsuperscript{st} Stage – Cognitive Phase
Participant gains understanding through faculty explanations & demos

2\textsuperscript{nd} Stage – Associative Phase
Participant practices task & eliminates error with faculty feedback, identify error, recommend corrective measures
Rogers, et al.

- Three-stage Motor Skills Model
  - 3rd Stage – Autonomous Phase
    Participant performs task, automatically with little or no cognitive input
Learning Factors Survey
# Rank Order Survey Results (N=22)

<table>
<thead>
<tr>
<th>Learning Factors</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensory-Motor</td>
<td>2.27</td>
</tr>
<tr>
<td>Perception/Imagery</td>
<td>2.72</td>
</tr>
<tr>
<td>Decision-Making</td>
<td>3.86</td>
</tr>
<tr>
<td>Memory</td>
<td>4.18</td>
</tr>
<tr>
<td>Problem-Solving, Troubleshooting</td>
<td>4.45</td>
</tr>
<tr>
<td>Cognitive Learning Styles</td>
<td>4.68</td>
</tr>
<tr>
<td>Motivational Factors</td>
<td>5.45</td>
</tr>
</tbody>
</table>
Teaching Methods Survey
Participant Self-Evaluations

- Baseline
- Interim i.e., Pre-Lab
- Group Consensus Taking
- Final
- Post-Course Follow-up
Syllabus & Handouts
Faculty/Participant Polling
Case Presentations
Interactive Telesurgery
Questions & Answers

- Formal Setting, i.e., Classroom
- Informal Setting, i.e., Breaks
- Focus Group Tables, i.e., Lunch
- Interactive Teleconference, i.e., Telesurgery
- Post-Course Email (Participant-Faculty)
Demonstrations
Laboratory Models
Inanimate
Laboratory Models
Trainers
Laboratory Models
Research Exercise
Laboratory Models
Cadaveric
Laboratory Models
Animate
Laboratory Models

Simulator
Preceptor/Proctorships

- Foundation for Advanced Medical Education/Philadelphia Health Care Trust (Preceptorship through professional societies, e.g., AATS/STS)
- Yale – Rosser Model
- PI MIT Model (Visitors)
- Feagins Model/Company Driven
Other Teaching Methods or Techniques
Recommendations & Summary
Rogers, et al.

- Recommendations to Surgeons Learners
  - **Course** – Set of objectives for technical task with specific performance characteristics & assessment measures e.g., perform technique in given period with prescribed success rate.
Rogers, et al.

- Recommendations to Surgeons Learners
  - Course – Qualified faculty
    - Based on LC performance data on teaching models and patients
    - Based on qualitative & quantitative assessments from prior course participants
    - Evidence that participants can master technique in course through estimates of past participants’ post-course abilities to perform.
Rogers, et al.

- Recommendations to Surgeons Learners
  - Course – Sufficient faculty present to provide individual feedback.
    - 1:4 faculty-participant ratio shown to have positive learning effect. (Need more data.)
    - Rosser, 1998 Arch Surg
Rogers, et al.

- Recommendations to Surgeons Learners
  - Participants – appropriate fundamental knowledge, skills, & clinical experience
    - Baseline survey – current experience & mastery level
    - Pre-test vs. Post-test might provide evidence of educational effectiveness
Rogers, et al.

- **Recommendations to Surgeons Learners**
  - Adequate facility
    - Sufficient number of inanimate and animate models available
    - Sufficient facilities for participant practice until demonstration of desired technique mastery based on position on LC
Rogers, et al.

- **Recommendations to Surgeons Learners**
  - **Curriculum** -- Incorporate materials reducing time required at course & enhancing learning
    - Videotapes of procedure to participant prior to course for participant procedure rehearsal before practice session
    - Videotape can also record participant performance in lab for self-critique and faculty feedback
Rogers, et al.

- Recommendations to Developers & Accrediting Agencies
  - Conduct formal “task analysis”
  - Estimate degree of “new motor skill”
  - Analyze inventory of “frequent occurrence errors”
  - Develop specific course goals & Objectives
  - Develop curriculum with faculty-participant ratios, lab protocols, assessment methods
Rogers, et al.

- Recommendations to Developers & Accrediting Agencies
  - Task analysis & curriculum approved by accrediting agencies
  - Goal: innovation is introduced with maximal safety to patients
Rogers, et al.

- Recommendations to Developers & Accrediting Agencies
  - Monitor course elements needed to produce effective learning
  - Evaluate course on performance data in course and in participant’s practice after course.
Rogers, et al.

- Recommendations to Developers & Accrediting Agencies
  - Reevaluate the SAGES supervised experience requirement
  - Encourage participants to bring an assistant or partner to course
Rogers, et al.

- Recommendations for Educational Research and Study
  - Evaluate effectiveness of CMEST short courses
    - Establish predictive validity between performance on models and performance on patients
    - Establish effectiveness use of computer-based instruction
Rogers, et al.

- Recommendations for Educational Research and Study
  - Develop and evaluate alternatives to CMEST short courses
  - Determine feasibility of training network
Rogers, et al.

Recommendations for Educational Research and Study

- Determine which attributes of effective CME apply to CMEST
  - Rate of complications drops when participants bring partner to course. See, 1993 JAMA.
- Find ways to improve the efficiency of CMEST
  - Participant expense and time away from practice
Please contact us…

- Marilyn A. Peterson, MA
  Director, CME
  Texas Health Research Institute
  PIMIT
  8200 Walnut Hill Lane
  Dallas, Texas 75231
  214/345-5380 voice; 214/345-5393 FAX
  Email: MarilynPeterson@texashealth.org
  Website: www.pimit.org
Please contact us…

- Sandra Pinkerton, PhD
  Director, Academic Activities
- Texas Health Research Institute
  6300 W. Parker Rd, Suite 100
  Plano, Texas 75093
- 972/981-3752 Voice; 972/981-3779 FAX
- Email: sandrapinkerton@texashealth.org
- Website: www.thri.org