the future of anesthesia education*

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International Anesthesia Research Society, National Institutes of Health

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St. Elizabeth’s Medical Center
University of Cincinnati
University of Iowa
SUNY Downstate Medical Center
John H. Stroger, Jr. Hospital

University of Kansas-Wichita
Mayo Clinic
Tulane University
University of Illinois
Loyola Medical Center
The Tides Foundation

Columbia University
New York University
Tufts University
University of Rochester
University of Tennessee
San Antonio Foundation
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#1: Teachers as designers
Effective learning by design
the two sigma paradox

1:30 CONVENTIONAL

1:30 MASTERY

1:1 TUTORIAL

SUMMATIVE ACHIEVEMENT SCORES

AVERAGE STUDENT IN TUTORIAL
>98% CONTROL

IN MASTERY
>84% CONTROL

THE 2-SIGMA PROBLEM: THE SEARCH FOR METHODS OF GROUP INSTRUCTION AS EFFECTIVE AS ONE-TO-ONE TUTORING. BLOOM, B.S. EDUCATIONAL RESEARCHER, VOL 13, NO 6 (JUN-JUL 1984) PP. 4-16
TEACHERS AS DESIGNERS

NEW TOOLS—SAME GOALS

EFFECTIVE LEARNING BY DESIGN
CHALLENGE FOR TEACHERS
UNDERSTAND NEW INSTRUCTIONAL TECHNOLOGIES
#2: EMPATHY FOR LEARNERS

WHO ARE TODAY’S ANESTHESIA LEARNERS?
high adoption of computer technologies

- Novice
- Somewhat Knowledgeable
- Knowledgeable
- Very Knowledgeable
- Power User

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<tr>
<th>Year</th>
<th>Novice</th>
<th>Somewhat Knowledgeable</th>
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mobile and data-connected generation of learners

- iPhone
- Android Phone
- Other


Percentage:
- 50%, 54%, 31%, 21%, 24%, 25%
- 9%, 4%, 2%, 2%, 3%
- 59%, 88%, 98%, 99%, 104%
anesthesia residents are heavy adopters of tablet devices
residents believe tablets under-utilized in their education

- Strongly agree that "a mobile device such (e.g. iPad) would enhance my ability to learn in a meaningful way" (2014: 60%, 2012: 45%)
- Strongly agree that "mobile devices (e.g. iPads) are under-utilized in anesthesia education" (2014: 30%, 2012: 15%)

Stanford Medicine
Anesthesia Informatics and Media Lab (AIM)
Anesthesiology, Perioperative and Pain Medicine

Strongly agree that "mobile devices (e.g. iPads) are under-utilized in anesthesia education"
residents believe tablets enhance multiple educational uses

- Enabling opportunities for learning to occur more frequently
- Increasing the convenience for learning
- Increasing opportunities for learning outside of the hospital
- Increasing opportunities for learning in the OR

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<thead>
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<th>Unimportant</th>
<th>Of Little Importance</th>
<th>Mod. Important</th>
<th>Important</th>
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Bar graph showing the level of importance for different educational uses.
anesthesia residents seek help first from online sources

...where do you typically go first for help?
anesthesia resident are not content creators, they’re consumers

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Creator
Critic
Collector
Joiner
Spectator
Inactive

2010  2011  2012  2013  2014
social media account ownership

- Twitter Account
- Facebook Account
- MySpace Account
- Youtube Account
- Blogger Account
- Social Bookmarking Account
- Wikipedia

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+508%
+325%
-71%
-57%
#3: THOUGHTFUL USE OF EDTECH
WHAT ARE THE UNIQUE AFFORDANCES YOU SEEK?
screen-based simulation increases feeling of preparedness

PROJECT
10 month online elearning curriculum designed to prepare anesthesia interns for residency training. Launched in 2009. Now deployed at 23 schools nationwide.

RESULTS
Post-curriculum quiz scores improved by an average of 24% each month (p<0.0001), self-assessed preparedness scores improved by 72.2% (p=0.02) after completing the online course. Mean AKT-1 scores were 14% higher in the START cohort (86.2%ile nationally) vs. historical control (75.8%ile national) (p=0.03).

how might we scale experiential learning?

“Net Gen learners are experiential, prefer to learn by doing rather than being told what to do. This enables them to better retain information and use it in creative, meaningful ways.”

Oblinger and Oblinger, Is it Age or IT, First Steps Toward Understanding the Net Generation, 2005
How can we engage today's residents through experiential learning using video?

Framework: First-person POV video games.
ethercast

INDUCTION OF GENERAL ANESTHESIA
#4: BRING LEARNING TO SCALE

ROLE OF CURATION AND PERSONALIZE LEARNING
CURRENT AIM LAB MOOC COURSES

Medical Education in the New Millennium

Engage + Empower Me

STARTprep: Anesthesia Basic Sciences

START Anesthesia Residency
DEFINITION

MASSIVE OPEN ONLINE COURSE
MOOC

- Massive
- Open
- Online
- Course

- Focus on scalability
- Focus on community and connections

- What is massive?
  - 100?
  - 1,000?
  - 10,000?
  - 100,000?

- Local cohorts?
- Open registration?
- Self-paced?
- Start/end dates?
- College credits?
- Badges?
- Role of the instructor?
- Learning community?
- Scripted assessments and feedback?

- Open content?
- Free of charge?
- Affordable?
- Real-time interaction?
Medical Education in the New Millennium

overview

ABOUT THIS COURSE

This interdisciplinary course features talks from thought leaders and innovators from medical education, instructional design, cognitive science, online learning, and emerging technology. Over the course of eleven weeks, we’ll consider how to build educational experiences that address the unique learning preferences of today’s Millennial medical students and residents. As the volume of new medical knowledge outpaces our ability to organize and retain it, how might educators disrupt outdated practices through thoughtful use of technology and learning design? How might MOOCs, social media, simulation and virtual reality change the face of medical education? How might we make learning continuous, engaging, and personalized for all students?

Course Number

ANES204

Classes Start

Oct 01, 2014

OUR RESEARCH COMMUNITY

Stanford University pursues the science of learning. Online learners are important participants in that pursuit. The information we gather from your engagement with our courses helps us research and develop learning experiences that work best for you.
Cognition and Learning

Bringing the Patient Voice to Medical Education

Reimagining Undergraduate Medical Education

Simulation, Part-task Trainers, and 3D-printing

Social Media: Harnessing Distributed Expertise

Introduction to the Course

Getting Started with Medical Education in the New Millennium

A Patient's Perspective: Britt Johnson

Speakers: Larry Chu, MD, MS, Kyle Harrison, MD, Nikita Joshi, MD

Discussion Question

VIDEO

victim.

But in recent years the patient movement have redefined what it means to be a patient.

We are no longer the noun or the passive definition of the patient.

We're the adjective quote, quietly and steadily persevering.

Well, maybe not so quietly, but we are the provocation.

We have expressed our annoyance with the healthcare system.
KEY INSIGHT

"If the practice of participatory medicine requires a team effort, could we think of medical education in the same way?"

-Dr. Larry Chu
STARTPREP MOOC

21 Months
1400 Anesthesia Learners
48/133 Programs = 36% US
1 Australia
1 South Africa
2014: 1400/3517 = 40% US
BACKGROUND

• **Majority of current residents are millennial learners**, incorporating new technologies and fast, mobile delivery of information.

• **Accustomed to mobile, online learning from grade school through medical school**, expecting similarly sophisticated teaching modalities in residency.

• **STARTprep was created to meet this need for a time-shifted, place-shifted method of learning that strategically promotes an incremental model of studying** (vs. cramming) to prepare residents for high stakes educational milestones.
UNIQUE AFFORDANCES

340+ online learning modules, organized around anesthesia basic sciences. STARTprep is not marketed as a board review course.
UNIQUE AFFORDANCES

- Daily trigger email
- Short online reading
- Knowledge Assessment Questions
Introduction to Lesson

Monday, September 8, 2014

Ventilators: Classification: Flow Generation vs. Pressure Generation

James M. Hunter, Jr., MD
Assistant Professor of Anesthesiology and Surgery
University of Alabama at Birmingham

Learning Objectives:

After completing this lesson the learner will be able to:

1. Describe the flow patterns in flow-targeted and pressure-targeted mechanical breaths.
2. Contrast how changes in lung compliance and chest wall compliance affect airway pressure and tidal volume in a flow-targeted breath vs. a pressure-targeted breath.
3. Contrast how changes in airway resistance affect airway pressure and tidal volume in a flow-targeted breath vs. a pressure-targeted breath.
4. Explain how pressure support differs from pressure control.

What would you do?

A 52-year-old woman is slow to awaken after general anesthesia for total abdominal hysterectomy. She is transported to the PACU and mechanical ventilation with volume-control is initiated. 30 minutes later, the nurse calls because the patient is "fighting the ventilator" and the peak inspiratory pressure alarm is sounding. Evaluation reveals that the patient is attempting to exhale toward the end of mechanical inspiration. How might the choice of mechanical breath type influence the patient’s ability to tolerate mechanical ventilation? How would changing to pressure-support change the situation? You’ll uncover our answer after completing today’s module!
Positive Pressure Breaths

The flow pattern of a mechanical breath is determined by parameters controlled by the ventilator. These include: airway pressure, tidal volume, flow, and duration.

This chapter describes the common types of positive pressure breaths:

- volume-control
- pressure-control, and
- pressure support.

Each of these breath types is useful in the operating room. For example, pressure support can be used with an LMA during eye surgery to reduce movement of the eye due to the patient's inspiratory efforts.

Check your understanding!

- List the parameters that can be controlled by the ventilator in delivery of a positive pressure breath.
Question 1
Marked out of 1.00

How is most blood carbon dioxide transported?

Select one:
- A. As carbaminohemoglobin
- B. As bicarbonate ion (HCO₃⁻)
- C. As dissolved CO₂
- D. As carbonic acid (H₂CO₃)

Question 2
Marked out of 1.00

Which of the following is NOT a determinant of mixed venous oxygen content?

Select one:
- A. Hemoglobin
- B. Arterial oxygen content
- C. Oxygen consumption
- D. Partial pressure carbon dioxide
- E. Cardiac output
WHO’S USING STARTPREP?

99% used learning technologies in college

59% completed an online course before
81% of residents who have been using the course for at least 3 months say that STARTprep is more engaging than traditional study methods.

86% of residents say STARTprep is more engaging than traditional lectures.
LEVEL OF ENGAGEMENT OVER 24 HOURS

# INTERACTIONS WITH LESSON

TIME OF DAY (HOURS)
37% of STARTprep residents are regular users, compared with 7% average completion rate for MOOCs.

88% of STARTprep residents say makes them feel more prepared for high stakes milestone exams.
98% of residents say they use STARTprep to learn and study at convenient times not possible with in-person courses.

**Podcasts**
- Podcast episodes have been downloaded 2,604 times across eight countries.

**Time Shifting**
- 98% of residents rate STARTprep chapters as being good, very good or excellent.

**Participation**
- 1/3 or residents open daily course emails and 29% click through to the course.

**Demographics**
- 42% female
- 62% ages 25-30
- 45% on Facebook
- 22% 1st caregiver

**Mobile Learners**
- 58% of residents primarily access STARTprep from a mobile device such as an iPhone.

**990 Residents**
- 42% female
- 62% ages 25-30
- 45% on Facebook
- 22% 1st caregiver

95% of residents rate STARTprep chapters as being good, very good or excellent.

86% of residents say STARTprep is more engaging than traditional lectures.

88% of residents say that STARTprep makes them feel more prepared for high-stakes educational milestones.
• **92% of respondents** say that STARTprep helps them make better clinical decisions

• **94% say** STARTprep helps them **feel more prepared for daily cases**
Initial results show the program helps learners:

- **Feel more prepared for high stakes educational milestones**
- **Engages learners more** than traditional lectures and study methods
- Allows residents to **learn at times that are convenient** to their needs and lifestyles
- **Reveals strengths and gaps in residents’ knowledge** of the anesthesia basic sciences
Slow and steady wins the race! The key of STARTprep is it cuts out the wasted time in figuring out what to study. Each day there is a set topic for review.
OUTCOMES (2013 COHORT)

- Failure Rate: 0.8%

* p < 0.05

- National: 4%

STARTprep: 0.8%

*p < 0.05

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Anesthesiology, Perioperative and Pain Medicine
OUTCOMES (2013 COHORT)

Activities

- Failed: 2,837
- Pass: 4,394
- Top 10%: 6,854

*p < 0.08
#5: QUALITY OF LEARNING EXPERIENCE

ACKNOWLEDGE VULNERABILITY OF RESIDENTS
“She asked me to sit for a few minutes and, shamefully, I hesitated. I had eight more patients to see before rounds and was already running behind.”

Dhruv Khullar, MD
MGH Resident
“So far, residency educational reform has focused on the quantity of hours worked, not necessarily improving the quality of time spent at work.”

Dhruv Khullar, MD
MGH Resident