THE POWER AND PROMISE OF EDUCATIONAL TECHNOLOGY

Graham McMahon MD MMSc
President & CEO, ACCME
GRAHAM MCMAHON, MD, MMSC

• Disclosure
  No Conflicts to Report
CHANGING ENVIRONMENT

Administrative Burden
Productivity Expectations
Difficulty of work
Family expectations
Clinician
Patient expectations
When you turn it to the right, the wheel goes to the left.
Dinner

- Sweet potatoes
- Gallon of whole milk
- Bread rolls
- Leeks
- Whipping cream
- Meat
- Celery and carrots

- Package of cubed stuffing
- Pumpkin pie mix
- Fresh Berries
- Pie shells
- Frozen green peas
- Cloves
How do People Learn?

Instructional Presentation → Sensory Memory → Working Memory → Long-Term Memory
Meaningful Learning

Instructional Presentation → Sensory Memory → Working Memory → Long-Term Memory

Selecting → Organizing → Integrating
Learning Together and Being Self-Aware

We’re all different in what we
  Retain
  Associate
  Learn

Retention is improved with context and organization

Collaboration improves
  Performance
  Self-awareness
  Mutual respect
Typical Forgetting Curve for Newly Learned Information

- First learned
- Reviewed

![Forgetting Curve Graph](Image)

- Retention
- Days

Retention:
- 100%
- 90%
- 80%
- 70%
- 60%

Days:
- 0
- 1
- 2
- 3
- 4
- 5
- 6
- 7
DELIBERATE PRACTICE
Evolving Continuing Education Environment

1. Continuing education is a professional responsibility
2. Learning can be fulfilling, can bring people together, and can effectively improve and change performance
3. Practice environments and burdens on clinicians have changed dramatically; learning environments have not
4. Most clinicians can and need to improve, but many clinicians have poor self-awareness
5. To be effective, learning needs to be increasingly individualized, include periodic comparative performance, facilitate team- and group-learning, and allow data to be aggregated and flow; technology can help.
Learning can be Transformative

- Self-Awareness
- Engagement
- Relationships

Improvement → Change → Better Health
WHO HERE IS A BELOW-AVERAGE DRIVER?
WHAT FRACTION OF PHYSICIANS CONSIDER THEMSELVES AT LEAST AVERAGE IN THE CARE THEY PROVIDE?
What’s Holding us Back?

- Many people are complacent about and have difficulty identifying their own areas for growth
- It is nearly impossible to surmise what you do not know
- We are poor assessors of the extent of our own deficits
- Practice types and learning needs are extremely diverse – there is no standard curriculum for clinicians in practice
Impact of poor self-awareness

- Low ability
  - Over confidence
  - Errors

- High ability
  - Vacillation
  - Delays, over testing
Clinician Education

Advantages
- High educational attainment
- Intellectual acumen
- See lifelong learning as a responsibility

Challenges
- Established learning prefs
- Poor self-awareness
- Data issues
- Overwhelmed
- Reduced plasticity
CALL TO MIND A MASTER CLINICIAN

HOW DID SHE OR HE ACHIEVE MASTERY?
What needs to change?

Things the physician must change for themselves

Things the environment must change to support the physician
HOW DO WE BECOME MORE SELF-AWARE?

• Curiosity &
• Humility
SO HOW DO WE BECOME MORE SELF-AWARE?

WHAT CAN WE DO ABOUT IT?
EDUCATIONAL TECHNOLOGY

- WHAT COMES TO MIND?
Educational technologies are advantageous in providing:

- safe, controlled environments that eliminate risk to patients
- enhanced, realistic visualization and problem representation
- authentic contexts for learning and assessment
- instruction tailored to individual or group needs
- efficient learner control of the educational experience
- repetition and deliberate practice
- uncoupling of instruction from place and time
Educational Technology

- Effective & Efficient
  - Individualized
  - Adaptive
- Social
  - Connectedness
  - Comparative
- Fun
  - Games
  - New insights
- Data
  - Informative
  - Seamless
EDUCATIONAL TECHNOLOGY

EFFECTIVE & EFFICIENT
- INDIVIDUALIZED
- ADAPTIVE
WHAT WERE THE CIRCUMSTANCES OF A POWERFUL LEARNING EXPERIENCE YOU HAD?
Problem-Solving Group
Reads Problems

Try to explain solution

Get correct solution

Attempt analogous problem

Memory Group Reads Problems

Try to memorize problem

Get correct solution

Attempt analogous problem

Mem and Cog. 19 542 (1991) College students, RCT
Passive Teaching Methods

- Lecture: 5%
- Reading: 10%
- Audio-Visual: 20%
- Demonstration: 30%

Active Teaching Methods

- Group Discussion: 50%
- Practice: 75%
- Teaching Others: 90%
Mastery Learning

- Carefully designed and managed curricula
- Engaged learners and teachers in effortful activities
- Assessments with actionable feedback and steps towards constant improvement

- Knowledge
- Skill
- Better patient care practices
- Improved patient outcomes
- Lower health care costs

McGaghie WC, Barsuk JH, Wayne DB. Adv Med Educ Pract 2017:8; 393-4
Importance of Assessment

• Learners adapt learning approaches to context in which learning occurs
• Three basic approaches identified
  • Surface (memorization)
  • Deep (comprehension and application)
  • Strategic (adapted to expectations)
• Teaching methods influence learners’ approach to deep learning – can be positive or negative
• Education of competent physicians requires “substantial changes in teaching, curriculum and, particularly, assessment . . .”

Newble DI, Entwistle NJ: Medical Education 1986; 20:162-175
Diverse correct paths to solve one simple equation

Adaptive Spaced Education

Personalizes the content and spacing of the spaced education course for each learner

• Example –
  • Learner receive two spaced education questions every day.
  • Incorrect → repeated 2 weeks later.
  • Correct → repeated 6 weeks later.
  • Correct twice in a row → item is retired & is no longer repeated.
  • Learners complete the program when all are retired.

• Advantages:
  • Reduces the unnecessary repetition of mastered material.
  • Turns the spaced education course into a game.
  • Measures not only what physicians know, but how well they learn
In addition to aspirin and a statin, which one of the following medications is most appropriate for a patient with known coronary artery disease who has stable exertional angina?

- Candesartan
- Isosorbide dinitrate
- Metoprolol
- Diltiazem
- Lisinopril

HOW CONFIDENT ARE YOU?
- I know it
- Think so
- Unsure
- No idea
**CONFIDENCE VS. PERFORMANCE**

How often are you overconfident? Underconfident? View how aware you were of whether or not you knew the answer to the questions you practiced. By being able to correctly identify what you know and what you don’t know, you can focus your studies and - most importantly - improve your clinical decision making.

<table>
<thead>
<tr>
<th><strong>AWARE THAT YOU KNEW THE ANSWER</strong></th>
<th>64%</th>
</tr>
</thead>
<tbody>
<tr>
<td>You were conscious of the fact that you knew the correct answer. If you have a high percent in this category, you are well on your way to mastering the subject. You should still practice once in a while to keep your new knowledge fresh - you don’t want to get rusty.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>AWARE THAT YOU DIDN’T KNOW THE ANSWER</strong></th>
<th>12%</th>
</tr>
</thead>
<tbody>
<tr>
<td>You knew that you didn’t know the answer. That is OK! It takes time to learn new things. What is important is that you know which material you should study more. This is the first step towards improving. Just keep practicing and you will quickly learn this material!</td>
<td></td>
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<table>
<thead>
<tr>
<th><strong>UNAWARE THAT YOU KNEW THE ANSWER</strong></th>
<th>14%</th>
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</thead>
<tbody>
<tr>
<td>You thought you didn’t know the answer, even thought you actually did. When you are learning new material, it is easy to be uncertain about what you truly know and don’t know. One way to gain confidence is to keep practicing. As you get more questions correct you will start to trust in your new knowledge!</td>
<td></td>
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<table>
<thead>
<tr>
<th><strong>UNAWARE THAT YOU DIDN’T KNOW THE ANSWER</strong></th>
<th>10%</th>
</tr>
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<tbody>
<tr>
<td>You thought you knew the answer, but got the question wrong. If you have a high percent in this category, be careful! You may think you know the material better than you really do. You don’t want to make misguided clinical decisions or perform poorly on exams by being overconfident. Practice more to make certain you have learned the material.</td>
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The Spacing Effect

Weeks

Percentage Change from Baseline

-10 0 10 20 30

Spaced Education

Web-based Modules

77%; 580/583
“intervention group residents provided higher quality of care in the year of their intervention: they screened more patients for low bone density, screened more appropriately, and effectively treated more patients at high risk of fracture.”
Increased Efficacy with Online Learning?

Evidence suggests that online learning is more efficient:
- Gains in knowledge, skills, and attitudes occur faster than through traditional instructor-led methods.
- Improved efficiency increases motivation and performance.

Online learning is more flexible:
- Can accommodate diverse learning styles.

Online learners have demonstrated:
- Increased retention rates.
- Better utilization of content.
- Better achievement of knowledge, skills, and attitudes.
Social Learning

Social learning theory holds that learning
- is a cognitive process that takes place in a social context and
- can occur purely through observation or direct instruction
- can occur in the absence of motor reproduction or direct reinforcement

Bandura
Social Media and Physicians

• Passive consumer (90%)
• Engage with others (9%)
  • Sharing cases, experiences, solutions in closed groups
• Content producers (1%)
  • Create blogs, forums, information-sharing websites, videos

Issues:
  Time
  Ethical/legal
  Privacy
Help with lab interpretation

Patient is a 51 year old female who exercises daily (about 7 miles on the treadmill at a brisk walking pace) but is having great difficulty gaining/maintaining her weight. She is 5’8” tall and weighs between 104-110# despite eating two 40 oz jars peanut butter per day (14,000 calories) and otherwise mostly vegetables other very healthy foods. History otherwise significant for anxiety with some depression. Takes Metadate, 30 mg, once a day. Has been supplementing Vitamin D and B12 in addition to a daily multivitamin. Labs are attached below. I would love to know your thoughts.

Thanks.

Supporting Media

Categories: Endocrinology, Internal Medicine, Rheumatology

Comments (51)
Acute and Chronic Rhinosinusitis: A Comprehensive Review (Coursera)

Created by: Icahn School of Medicine at Mount Sinai  Delivered by: Coursera
Tought by: Satish Govindaraj

This course is designed to inform primary care physicians and general otolaryngologists about the differences between acute and chronic rhinosinusitis and how to distinguish and treat them. It is also applicable to individuals who wish to broaden their knowledge and vernacular about this disease process, especially those who may suffer from this condition.

The course has been divided into four modules, each of which is followed by multiple choice questions to help attendees further understand this condition:

Week 1 - CME Information, Accreditation and Introduction

Week 2 - Module 1: Normal Sinus Anatomy and Function (15 min. + quiz)

Week 3 - Module 2: Acute Rhinosinusitis: Diagnosis and Treatment (17 min. + quiz)

Week 4 - Module 3: Chronic Rhinosinusitis: Diagnosis and Treatment (18 min. + quiz)

Week 5 - Module 4: The Role of Surgery for Sinusitis and Activity Evaluation (36 min. + 2 quizzes)

The primary objective of this course is to provide physicians with a thorough understanding of how to better diagnose and treat patients who suffer from acute and chronic rhinosinusitis.

Already taken this course? Please rate.

Average: 9 (3 votes)
Fundamentals of Clinical Trials

Clinical trials play a pivotal role in evidence-based medicine. This course will discuss the design, conduct, analysis, and interpretation of Phase I-IV clinical studies.

About this Course
Small Cooperative Groups Online

- Learning is active, and skills developed through interaction with the environment (constructivism) and others (social learning)
- Expected skillsets
  - team player
  - good communication
  - ability to work virtually
- Synchronous or asynchronous
- Parallel vs. associative vs. cooperative
- When effective
  - Positive interdependence
  - Creates comparison and reflection
  - Shared achievement
  - Relationship development
Barriers to Learner Engagement

Lack of time/competing demands
Distraction/low attention span
Fatigue
Poor self-awareness/over-confidence
Ambivalence/lack of motivation
Group mentality
KEEP CALM AND HAVE FUN LEARNING

But.. Popular ≠ Effective
Creating Engagement

• Engage the heart, the mind, and with others
• Interesting, meaningful, achievable goal
• Individualize the offering
  • Build on prior learning
  • Personalized comparative feedback
• Make it collaborative
• Make it efficient
• Make it rewarding
  • Goal oriented, fun, positive
Flow Volume Plot

Instructions to subject: “Take a deep breath in, the blow out as fast and as hard as you can all the way.”

This diagram shows a person breathing on a water spirometer, which translates inspiration and expiration into the motion of a pen on a rotating paper roll. Use the ‘Show FVC’ button to perform a forced vital capacity maneuver, and compare the waveform and

VC = Vital Capacity
VT = Tidal Volume
TLC = Total Lung Capacity
FRC = Functional Residual Capacity
RV = Residual Volume
PVC = Forced Vital Capacity

Lung force vector
Chest wall force vector
Play vs. mirth

“...no matter how intent and focused a child is at that play, maybe even grimly determined they may be at that game play, if you asked them afterwards, they will say that they were having fun. So, the fun of game play is not non-stop mirth but rather the fun of engaging of attention that demands a lot of you and rewards that effort.”
Attributes of Engaging Games

- Clear and consistent rules
- Clear goal
- Clear rationale
- Mission connected to and dependent on your ability
- Plenty of support
- Lots of positive feedback
- Shared experience
QUESTION 5

In which of the following disorders is paroxysmal hypertension a major clinical feature? (Select all answers that apply.)

- Carcinoid syndrome  (Learn more)
- Cocaine abuse  (Learn more)
- Cushing's syndrome  (Learn more)
- Panic attacks  (Learn more)
- Pheochromocytoma  (Learn more)
- Primary hyperaldosteronism

Panic attacks and panic disorder are commonly seen by primary care physicians; excessive outflow from the amygdala to the hypothalamus, leading to sympathetic activation, may be involved.

Submit answer
ZERO HOUR: AMERICA'S MEDIC

Zero Hour is a mission-based 1st person game designed to train first responder EMS response for mass casualty incidents such as earthquakes and terrorist attacks, through treatment, triage, and incident command.

Target audience includes pre-hospital EMS practitioners, particularly paramedics. In addition to training, Zero Hour serves as an EMS recruiting tool.

<table>
<thead>
<tr>
<th>368 ER docs</th>
<th>Immediate correct %</th>
<th>% correct at 6 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Game Group</td>
<td>47</td>
<td>43</td>
</tr>
<tr>
<td>Text Group</td>
<td>36</td>
<td>26</td>
</tr>
</tbody>
</table>
Effectiveness of adaptive education

Primary outcome measure was time to BP target (<140/90 mm Hg).

One hundred eleven clinicians enrolled.

In multivariable analysis of 17,866 hypertensive periods among 14,336 patients, the hazard ratio for time to BP target in the SE game cohort was 1.043 (95% confidence interval, 1.007–1.081; P = 0.018).

The number of hypertensive episodes needed to treat to normalize one additional patient's BP was 67.8. The number of clinicians needed to teach to achieve this was 0.43.

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**Patient characteristics**

- Female
- Age
- DM
- CAD
- Initial SBP
- Initial DBP
- Anti-HTN meds
- Med Possession Ratio

**PCP characteristics**

- Physician PCP
- Panel size
- Pre-test score
EDUCATIONAL TECHNOLOGY

DATA
- INFORMATIVE
- SEAMLESS
Unifying data system

Practice
- Type
- Demography
- Diseases
- Activities
- Billing
- Outcomes
- Registry data

Learner
- Type
- Preferences
- Prior experience and performance
- Self-confidence
- Ability

Activities
- Type
- Content
- Performance
- Decision support

System
- CME
- MOC
- Group outcomes
- Educational needs
Inspiring Mastery

Concrete Experience

Observation and Reflection

Development of Ideas

Testing Ideas in Practice

Kolb, 1983
Key Themes…

- Terrific advantages in being a healthcare educator
  - Attainment, acumen, prof. responsibility, resources
- Major challenges in healthcare education
  - Learning preferences, self-awareness, burden, burnout, systems
- Change is hard but necessary
- Need to recognize and leverage key learning principles
- Leverage technology to create learning experiences
  - Engage, efficient, relevant, contextualized, comparative, repeated, fun
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